MANTHAN NEET 2025

Breathing and Exchange of Gases

Lecture-1

(Zoology)

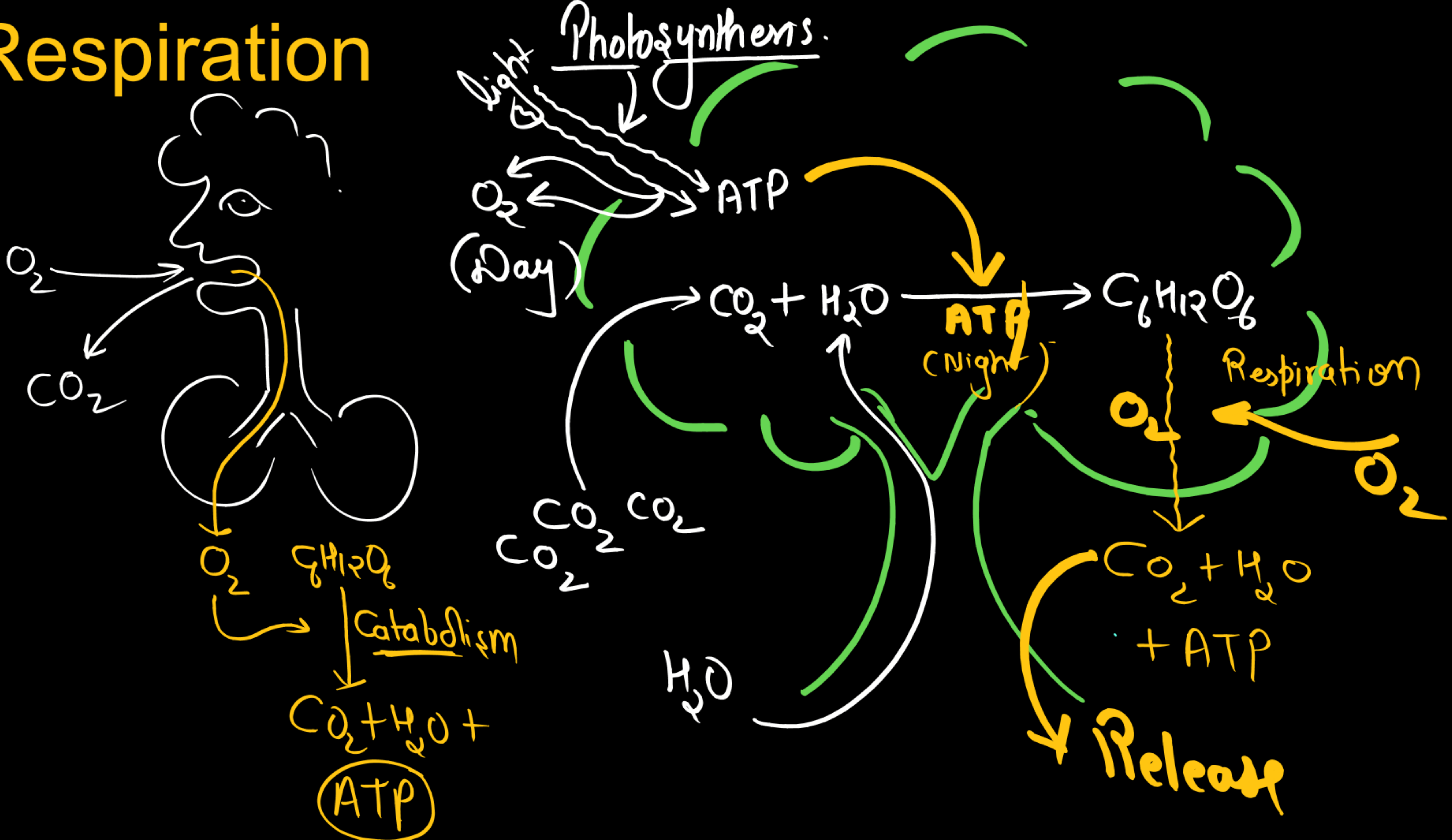
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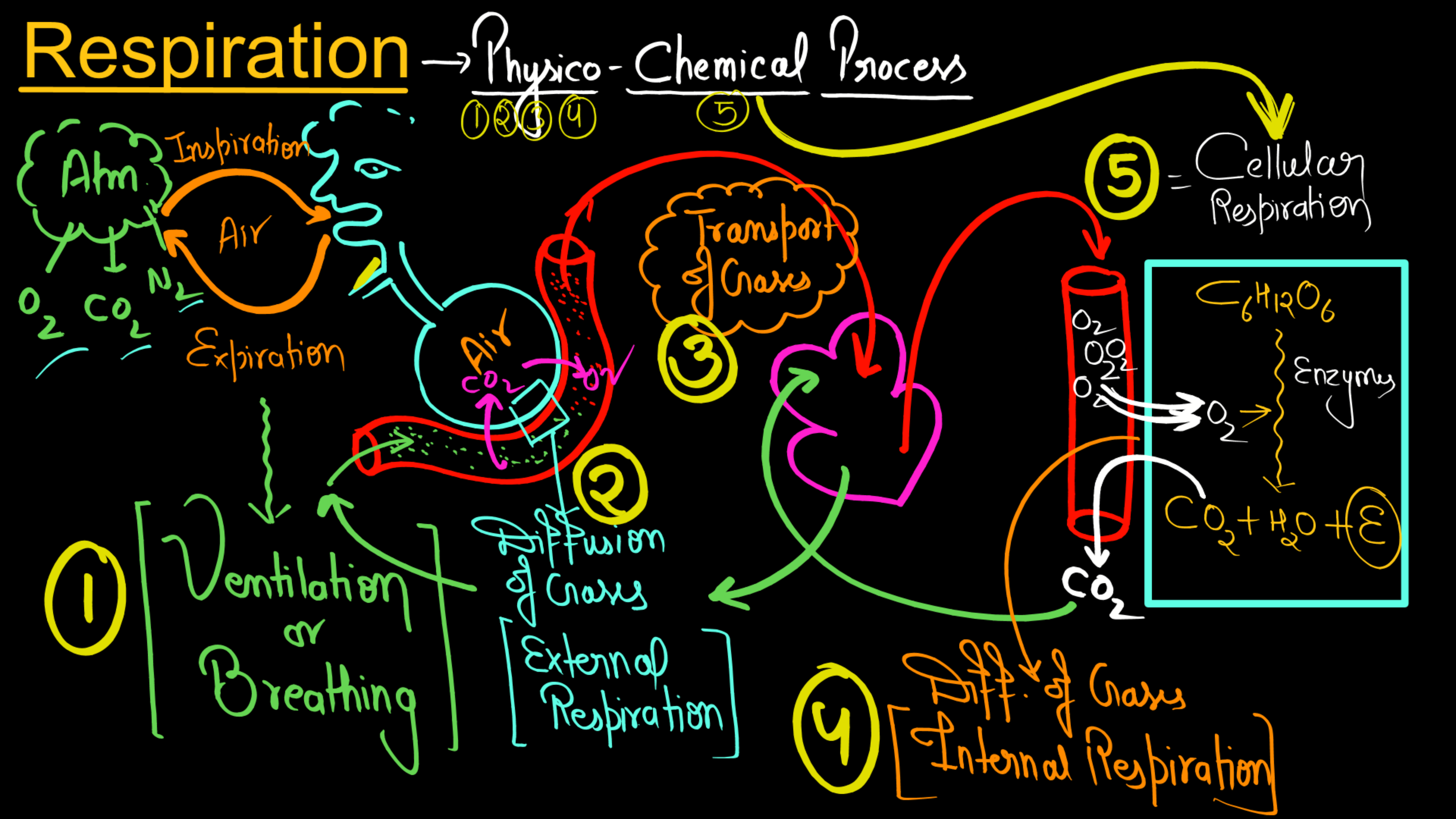


TODAY'S GOAL

- Respiration ✓
- Respiratory Organs in Animals ✓
- Human Respiration ✓

Respiration





Respiration → Physico-Chemical Process
1 2 3 4 5
Atm.
Inspiration
Air
Expiration
O2 CO2 N2
Air
CO2
O2
Transport of Gases
3
5 = Cellular Respiration
C6H12O6
Enzymes
O2
CO2 + H2O + E
CO2
1 [Ventilation or Breathing]
2 Diffusion of Gases [External Respiration]
4 Diff. of Gases [Internal Respiration]

Cellular Respiration →

Indirect breakdown of Amino acids, Glucose, Fatty acids.

Catabolism → $CO_2 + H_2O + \text{Energy}$ (Release)

- In presence of O_2 ✓
  [Aerobic Respiration]
  ⇓
  (38 ATP)

- In absence of O_2
  [Anaerobic Respiration]
  ⇓
  (2 ATP)

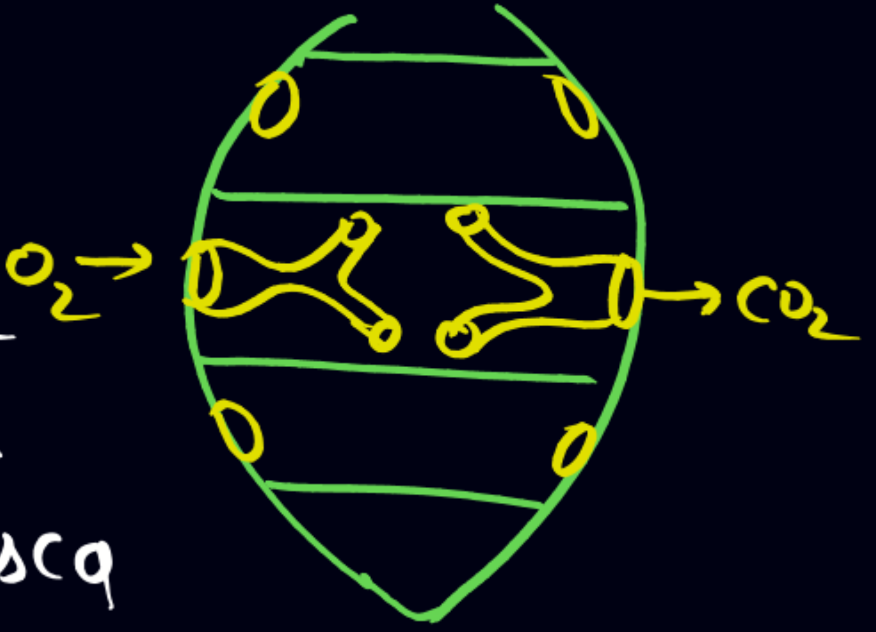
RESPIRATORY ORGANS

Mechanisms of breathing vary among different groups of animals depending mainly on their habitats and levels of organization.

Imp (habitats) — Imp (levels of organization)

- Body Surface → Porifera, Coelenterata, Ctenophora, Platyhelminthes (Planaria or) or Flat worm
- Mosit Cuticle & through Moist Skin } Cutanious Respiration
  - → Earthworm = [Skin + Nonliving Cuticle]
  - → Adult Frog } Moist Skin

- Network of Tubules [Trachial Respiration] → Insecta [Cockroach]



- Gills [Special Vascular Structure] → Fish + Aqua. Arthropoda. Aqua. Mollusca, Larva of Frog
  - ↳ [Branchial Respiration]

- Lungs [Special Vascularised Bags] → eg — Amphibia to Mammalia.
  - ↳ [Pulmonary Respiration]
    - Pulmonary — lungs.

BREATHING AND EXCHANGE OF GASES

As you have read earlier, oxygen (O_2) is utilised by the organisms to indirectly break down simple molecules like glucose, amino acids, fatty acids, etc., to derive energy to perform various activities. Carbon dioxide (CO_2) which is harmful is also released during the above catabolic reactions. It is, therefore, evident that O_2 has to be continuously provided to the cells and CO_2 produced by the cells have to be released out. This process of exchange of O_2 from the atmosphere with CO_2 produced by the cells is called **breathing**, commonly known as **respiration**. Place your hands on your chest; you can feel the chest moving up and down. You know that it is due to breathing. How do we breathe? The respiratory organs and the mechanism of breathing are described in the following sections of this chapter.

17.1 Respiratory Organs

Mechanisms of breathing vary among different groups of animals depending mainly on their habitats and levels of organisation. Lower invertebrates like sponges, coelenterates, flatworms, etc., exchange O_2 with CO_2 by simple diffusion over their entire body surface. Earthworms use their moist cuticle and insects have a network of tubes (tracheal tubes) to transport atmospheric air within the body. Special vascularised structures called **gills** (branchial respiration) are used by most of the aquatic arthropods and molluscs whereas vascularised bags called **lungs** (pulmonary respiration) are used by the terrestrial forms for the exchange of gases. Among vertebrates, fishes use gills whereas amphibians, reptiles, birds and mammals respire through lungs. Amphibians like frogs can respire through their moist skin (cutaneous respiration) also.

Respiration involves the following steps:

(i) Breathing or pulmonary ventilation by which atmospheric air is drawn in and CO_2 rich alveolar air is released out.

(ii) Diffusion of gases (O_2 and CO_2) across alveolar membrane.

(iii) Transport of gases by the blood.

(iv) Diffusion of O_2 and CO_2 between blood and tissues.

(v) Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2 (cellular respiration as dealt in the Chapter 14).

1. What is the last step involved in respiration?

(1) Diffusion of gases

(2) Breathing

(3) Utilisation of O2 by body cells and resultant release of CO2

(4) Transport of gases

2. The process of indirectly break down simple molecules like glucose, amino acids, fatty acids, etc., during which CO2, H2O and energy are produced is known as

(1) Breathing

(2) Ventilation

(3) Respiration

(4) Expiration

3. Mechanisms of breathing vary among different groups of animals depending mainly on their

(1) Reproduction
(2) Habitat and level of organisation
(3) Excretion
(4) Nutrition

4. During catabolic reactions, O_2 has to be continuously provided to the cells and CO_2 produced by the cells have to be released out. This process of exchange of O_2 from the atmosphere with CO_2 produced by the cells is called:

(A)Respiration
(B)Breathing
(C)Ventilation
(D)All of these

5. Which of the following is incorrect regarding respiration?

(A) It involves production of carbon dioxide water.
(B) It takes place at every time, day and night
(C) No organism can live without respiration
(D) It involves directly break down of simple molecules like glucose etc., to derive energy to perform various activities

6. The tissue respiration refers to:

(A) Breathing
(B) Pulmonary ventilation
(C) Cellular respiration
(D) Both (A) and (B)

7. In lower invertebrates like sponges, coelenterates, flatworms, etc., exchange O2 with CO2 occurs through

(A) Tracheae
(B) Gills
(C) Book lungs
(D) body surface

8. Special vascularised structures are used by

(A) Earthworm
(B) Aquatic arthropods
(C) Aquatic molluscs
(D) Both (B) and (C)

Think Positively and
Positive Things Will Happen

THANK YOU

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Breathing and Exchange of Gases

LECTURE -2

ZOOLOGY

MD SIR



TODAY'S GOAL

- Human Respiratory System
- Mechanism of Breathing
- Respiratory Volumes and Capacities

1. What is the last step involved in respiration?

(1) Diffusion of gases

(2) Breathing

(3) Utilisation of O_2 by body cells and resultant release of CO_2

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(3)

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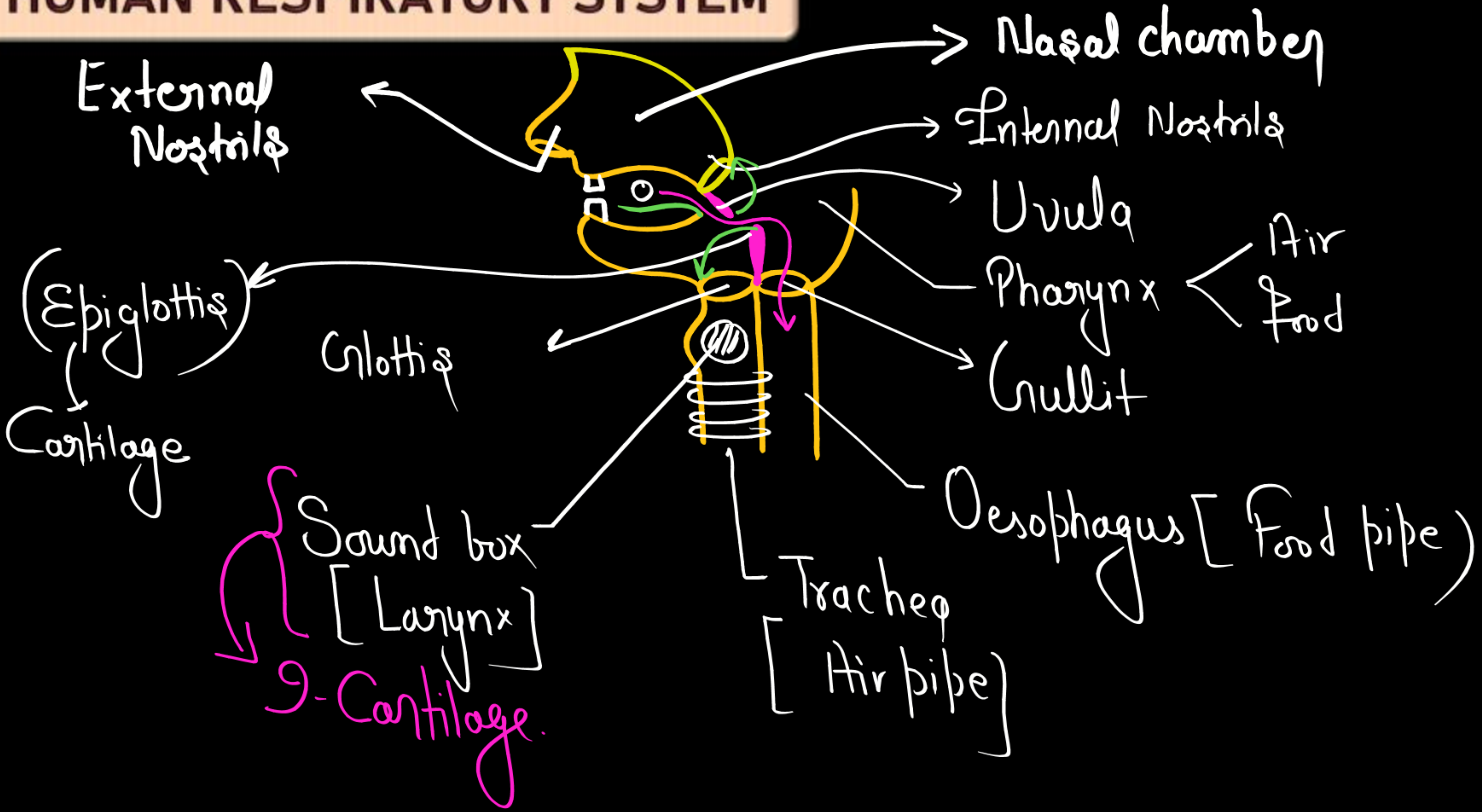
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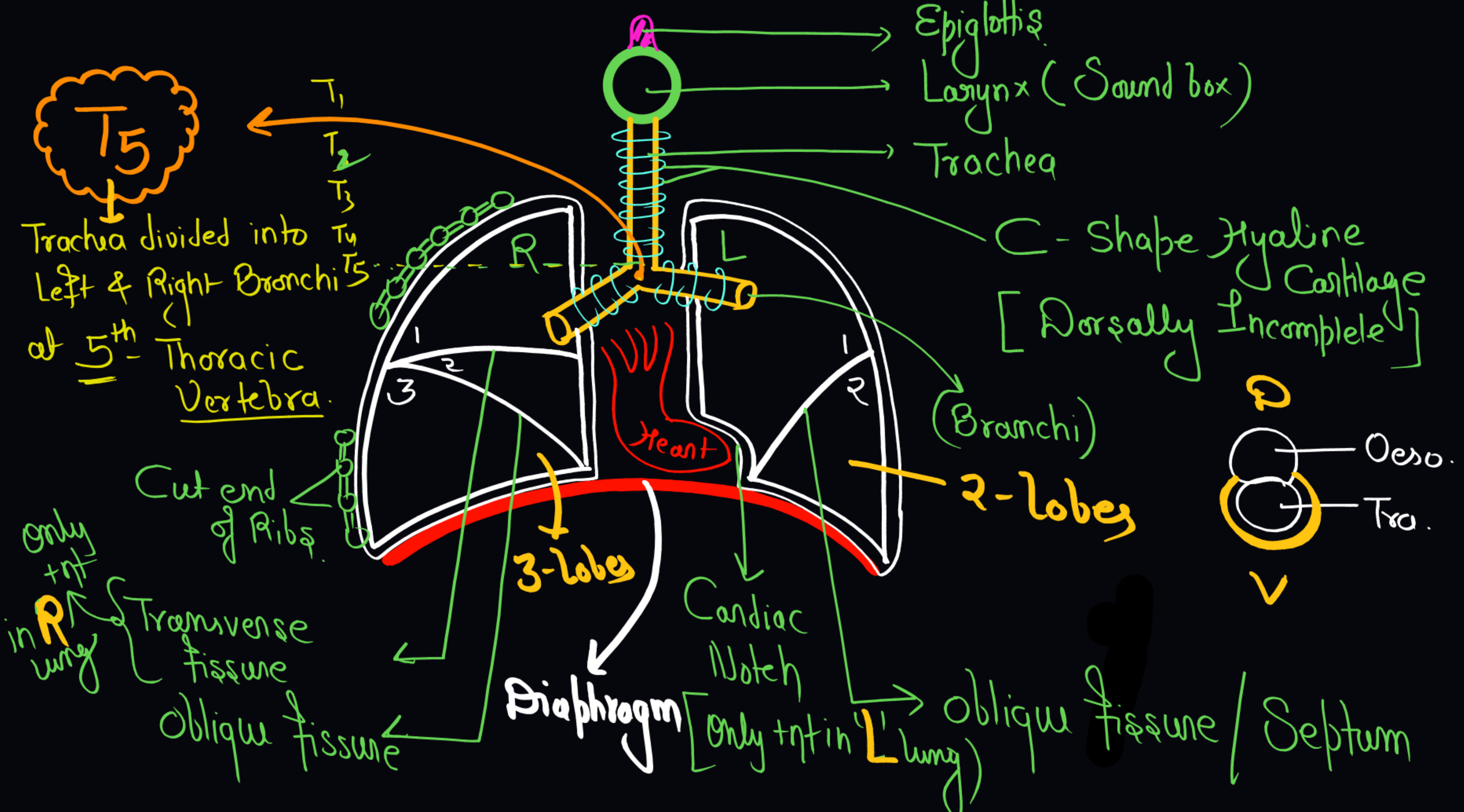
(A) Tracheae
(B) Gills
(C) Book lungs
(D) body surface

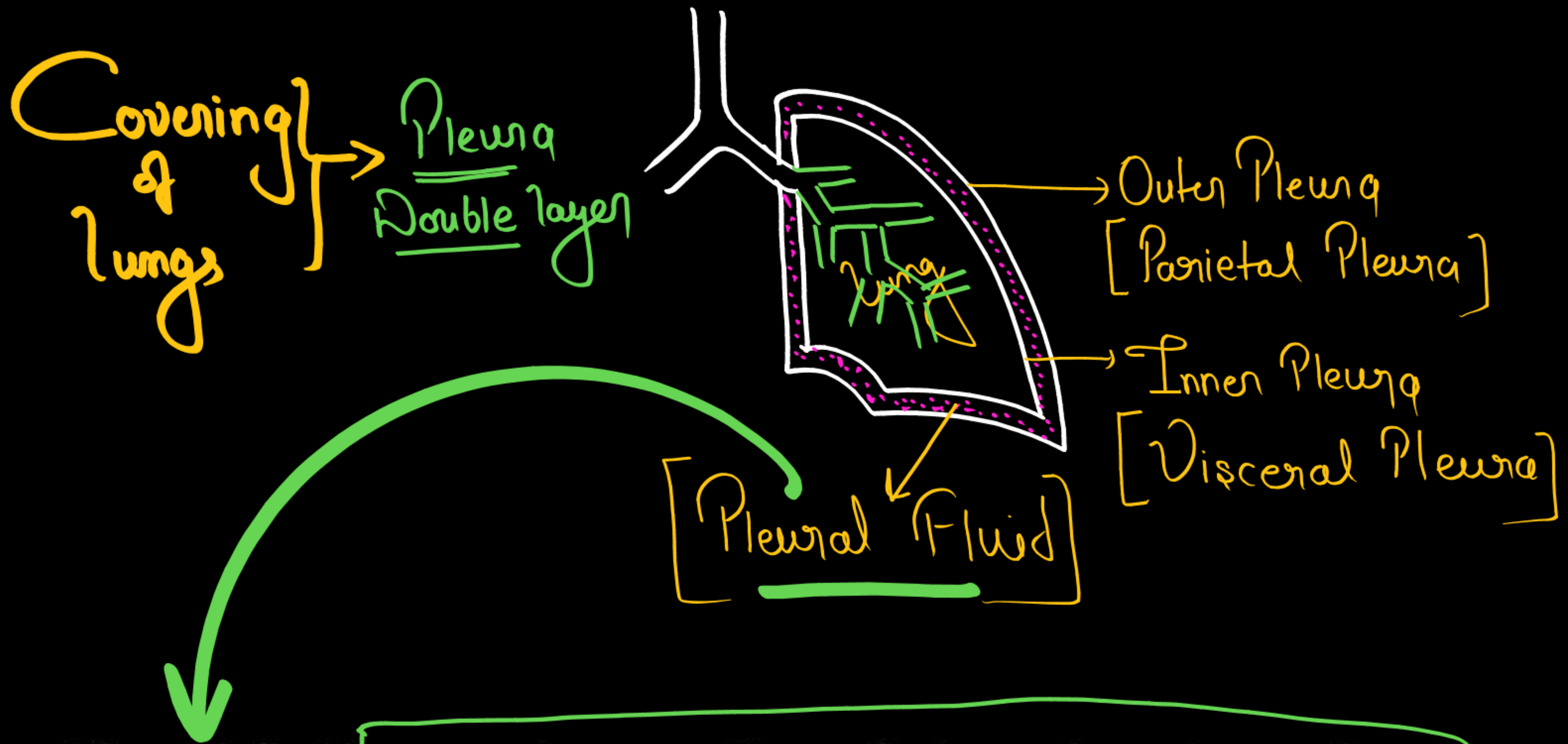
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(A) Earthworm
(B) Aquatic arthropods
(C) Aquatic molluscs
(D) Both (B) and (C)

HUMAN RESPIRATORY SYSTEM




T5
Trachea divided into Left & Right Bronchi at 5th Thoracic Vertebra.
T1
T2
T3
T4
T5
R
L
Epiglottis
Larynx (Sound box)
Trachea
C - Shape Hyaline Cartilage
[Dorsally Incomplete]
(Bronchi)
1
2
3
1
2
Heart
2-Lobes
3-Lobes
D
Oeso.
Tra.
V
Cut end of Ribs.
only in R lung
Transverse fissure
Obliqu fissure
Diaphragm
Cardiac Notch [Only in 'L' lung]
obliqu fissure / Septum



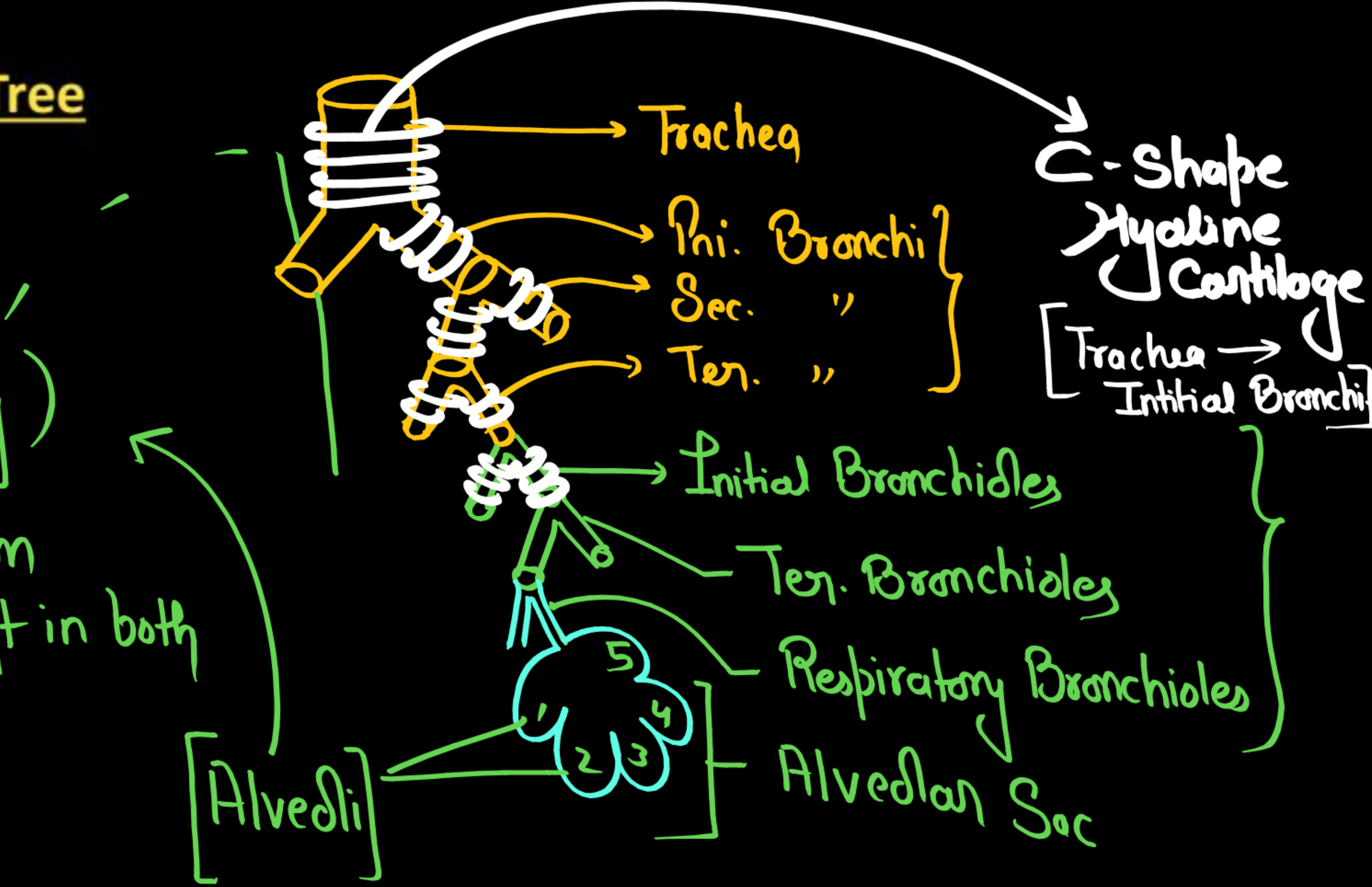
Note - Pleural fluid prevent separation of two pleural membrane and reduced friction from other organs

Respiratory Tree

(Unit of lung)

↓

✓ 300 million Alveoli tnt in both lungs.

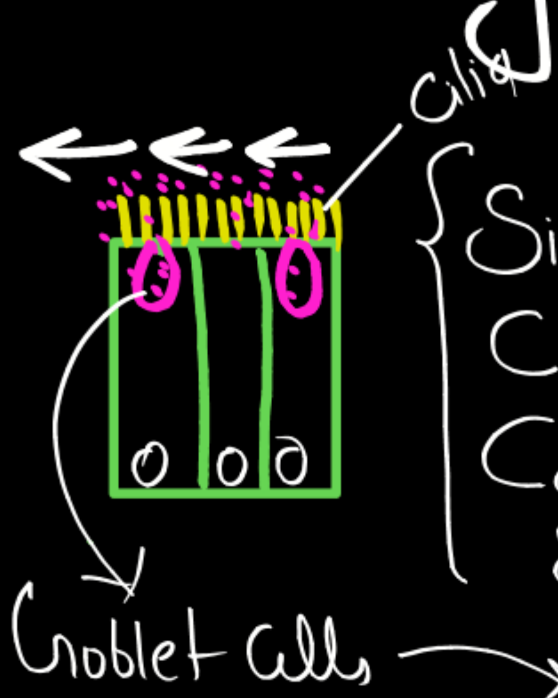


Function of Conducting zone

1. Conduction of air from Ex. Nostrils to Respiratory Zone
2. Clear conducting air from foreign particle
3. Humidification of air
4. Maintain temp. of conducting air according to body temp.

Trachea
Pri. Bronchi
Sec. Bronchi
Ter. Bronchi
Initial Bronchiole
Terminal "

Epithelial Tissue in Conducting Zone ⇒



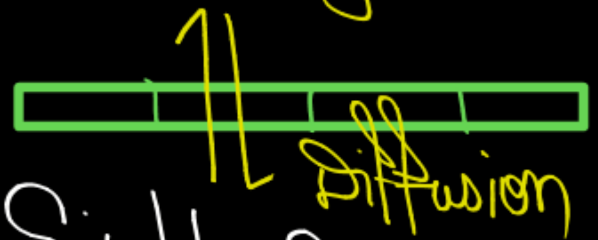
Simple Ciliated Columnar Epi. Tissue

Respiratory Zone

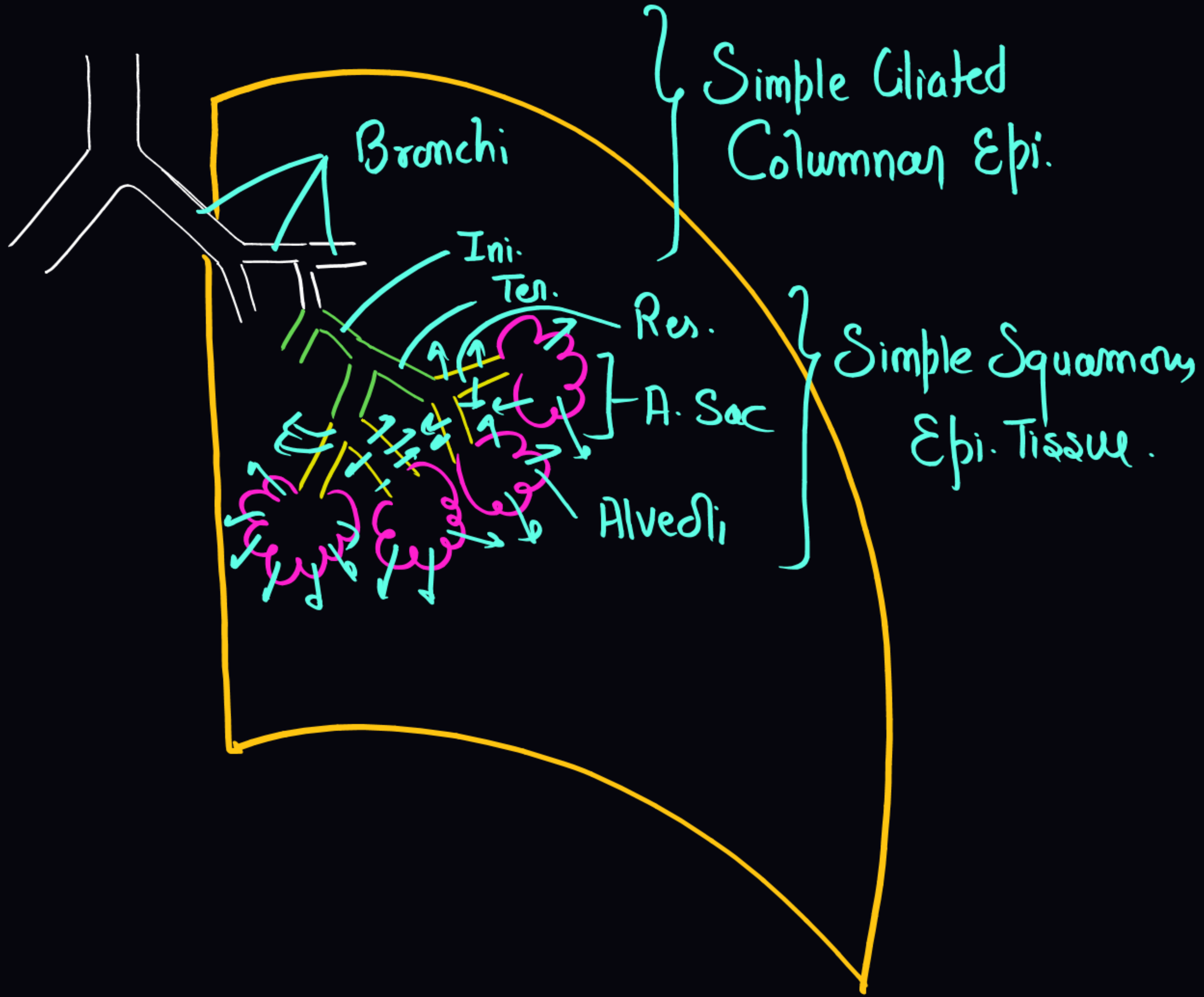
1. Diffusion of gases

Respiratory Bronchiole
Alveolar Sac
Alveoli

Epi. Tissue in Respiratory Zone.

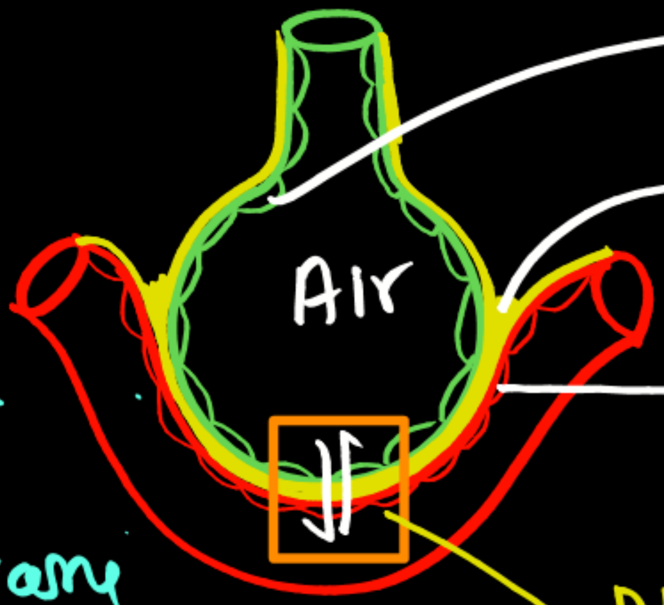


Simple Squamous Epi. Tissue



Bronchi
Simple Ciliated Columnar Epi.
Ini.
Ter.
Res.
A. Sac
Alveoli
Simple Squamous Epi. Tissue.

Structure of Alveoli



→ Simple Squ. Epi. of Alveoli

→ Basement Membrane.

→ Endothelium of Blood Capillary

No. of Diffusion layer = 3

- Simple Squ. of Alveoli
- Basement of both
- Endothelim of blood Capillary

(Thickness ⇓ (< 1 mm))

* Rate of Diffusion $\propto \frac{1}{\text{Thickness of Membrane}}$

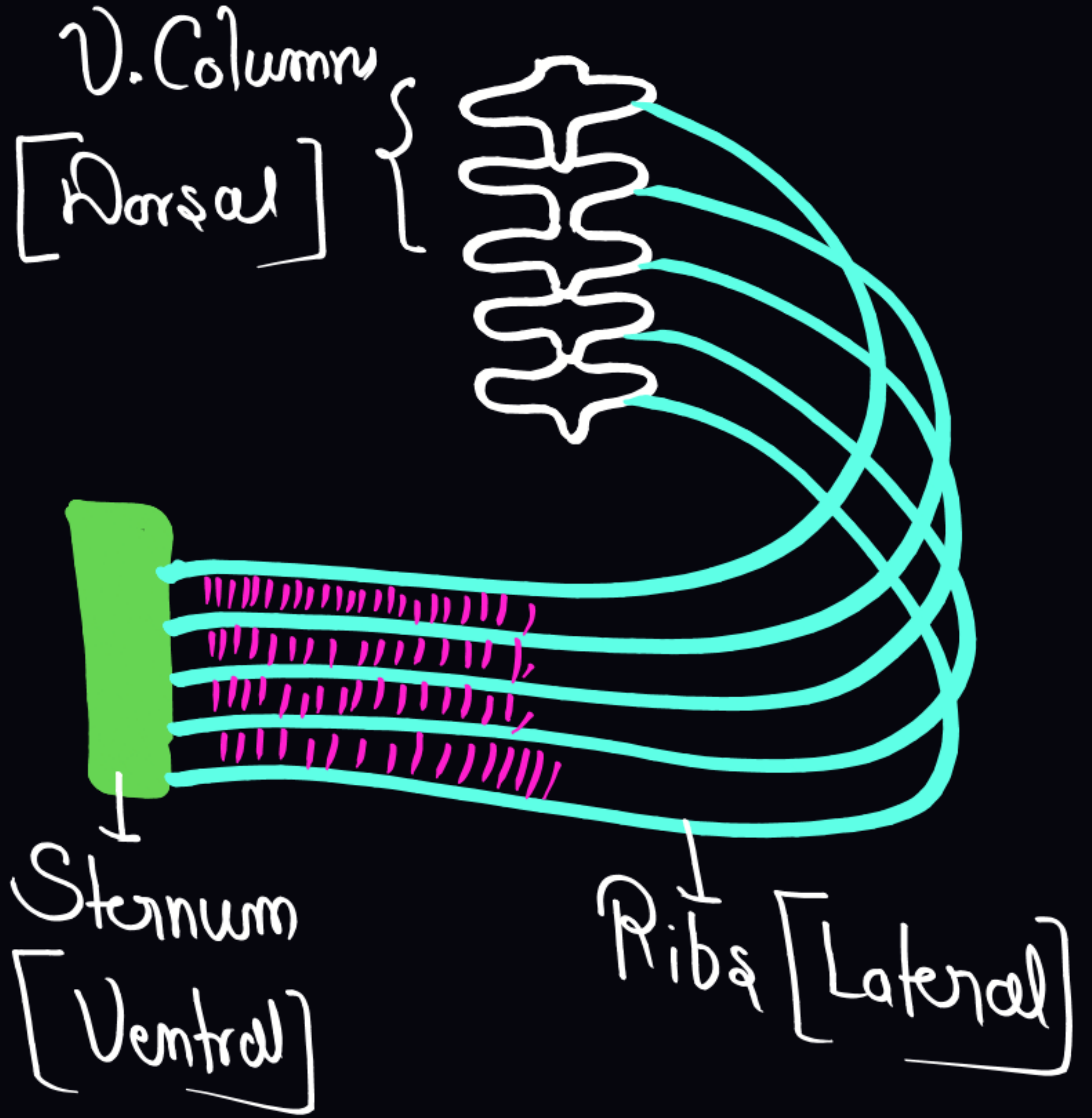
* Rate of Diff. $\propto$ Solubility of Gases

* Rate of Diff $\propto$ Partial Pressure of Gases.

vvvImp

Thoracic Chamber

Dorsally = V. Column
Ventrally = Sternum
Laterally = Ribs
Lower Side = Diaphragm



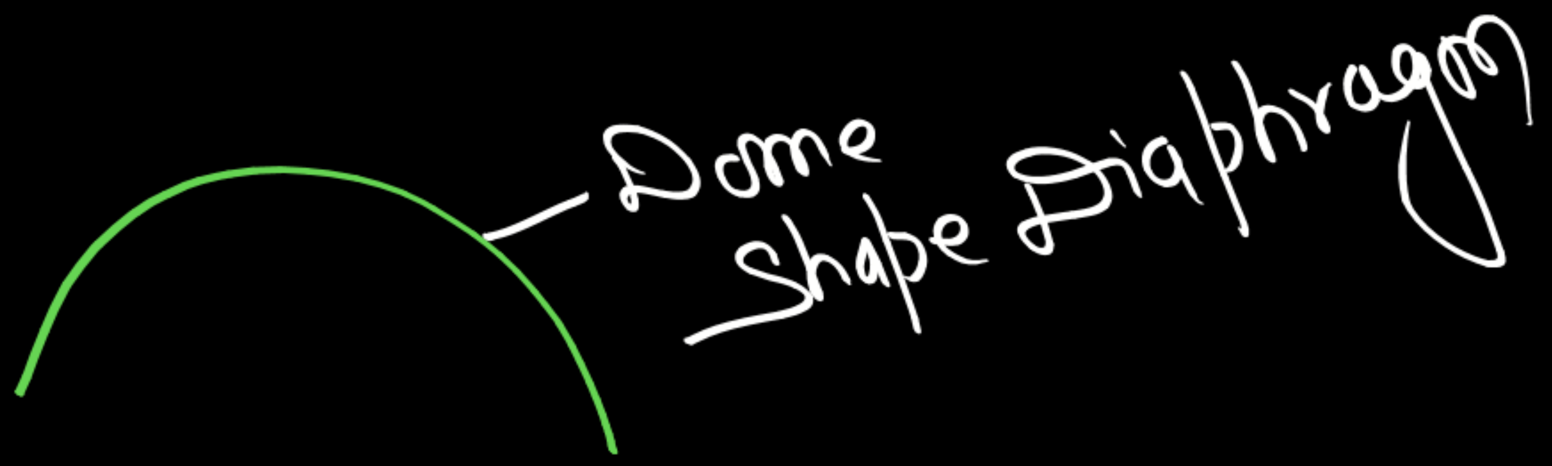
17.1.1 Human Respiratory System

We have a pair of external nostrils opening out above the upper lips. It leads to a nasal chamber through the nasal passage. The nasal chamber opens into the **pharynx**, a portion of which is the common passage for food and air. The pharynx opens through the larynx region into the **trachea**. Larynx is a cartilaginous box which helps in sound production and hence called the **sound box**. During swallowing glottis can be covered by a thin elastic cartilaginous flap called epiglottis to prevent the entry of food into the larynx. Trachea is a straight tube

prevent the entry of food into the larynx. Trachea is a straight tube extending up to the mid-thoracic cavity, which divides at the level of 5th thoracic vertebra into a right and left primary **bronchi**. Each bronchi undergoes repeated divisions to form the secondary and tertiary bronchi and bronchioles ending up in very thin terminal **bronchioles**. The tracheae, primary, secondary and tertiary bronchi, and initial bronchioles are supported by incomplete cartilaginous rings. Each terminal bronchiole gives rise to a number of very thin, irregular-walled and vascularised bag-like structures called **alveoli**. The branching network of bronchi, bronchioles and alveoli comprise the lungs (Figure 17.1). We have two lungs which are covered by a double layered pleura, with pleural fluid between them. It reduces friction on the lung-surface. The outer pleural membrane is in close contact with the thoracic

lining whereas the inner pleural membrane is in contact with the lung surface. The part starting with the external nostrils up to the terminal bronchioles constitute the conducting part whereas the alveoli and their ducts form the respiratory or exchange part of the respiratory system. The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles, humidifies and also brings the air to body temperature. Exchange part is the site of actual diffusion of O_2 and CO_2 between blood and atmospheric air.

The lungs are situated in the thoracic chamber which is anatomically an air-tight chamber. The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs and on the lower side by the dome-shaped diaphragm. The anatomical setup of lungs in thorax is such that any change in the volume of the thoracic cavity will be reflected in the lung (pulmonary) cavity. Such an arrangement is essential for breathing, as we cannot directly alter the pulmonary volume.



1. Air moves out of lungs when the intrapulmonary pressure is
(1) Less than the pressure in the atomosphere
(2) Greater than the pressure in the atomosphere
(3) Greater than the intra-alveolar pressure
(4) Equal to the pressure in the atomosphere

2. Which of the following is not found in the right lung?
(1) Superior lobe
(2) Cardiac notch
(3) Horizontal fissure
(4) Oblique fissure

3. Friction on the lungs surface is reduced by?

(A) Mucous membrane surrounding the lungs

(B) single layered pleura, with pleural fluid

(C) Double layered pleura, with pleural fluid

(D)The conducting part of the respiratory system

4. How many layers and thickness of diffusion membrane are?

(A) 5 and thickness 0.5 mm (B) 3 and thickness 0.6 mm

(C) 2 and thickness 0.1 mm (D) 3 and thickness 1 mm

5. The lungs are situated in the thoracic chamber which is anatomically an air-tight chamber. The thoracic chamber is formed dorsally by the ...A..., ventrally by the ...B... laterally by the ...C... and on lower side by the dome-shaped ...D...

Select the right choices for A, B, C and D to complete the given statement.

(A) A- sternum, B- vertebral column, C - ribs -. D- diaphragm

(B) A-vertebral column, B-ribs, C-sternum, D-diaphragm

(C) A- sternum, , B-ribs, C- diaphragm - D -vertebral column

(D) A-vertebral column, B-sternum, C-ribs, D-diaphragm

6. Regarding the function of conducting zone, mark the wrong statement?

(A) Clears it from foreign particles

(B) Diffusion of gases

(C) Humidifies

(D) Brings the air to body temperature,

7. How many statements are correct ?

(i) Mammals have negative pressure breathing.

(ii) The pharynx opens through the larynx region into the trachea

(iii) The trachea, primary, secondary and tertiary bronchi and initial bronchioles are supported by incomplete cartilaginous rings.

(iv) Larynx is a cartilaginous box which helps in sound production and hence called the sound box

(1) Two
(2) Three
(3) One
(4) Four

8. In mammals, the tracheal cartilaginous rings are:

(A) incomplete dorsally - Elastic
(B) incomplete Ventrally - Elastic
(C) incomplete dorsally -Hyaline
(D) incomplete laterally – Hyaline

1-8

9. The maximum volume of air you can forcefully exhale after taking the deepest possible breath is called.
(A) Tidal volume
(B) Total respiratory volume
(C) Residual volume
(D) Vital capacity

THANK YOU !!

MANTHAN NEET 2025

Breathing and Exchange of Gases

LECTURE -3



ZOOLOGY

MD SIR

TODAY'S GOAL

- **Mechanism of Breathing**
- **Respiratory Volumes and Capacities**

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Select the right choices for A, B, C and D to complete the given statement.

(A) A- sternum, B- vertebral column, C - ribs -. D- diaphragm

(B) A-vertebral column, B-ribs, C-sternum, D-diaphragm

(C) A- sternum, , B-ribs, C- diaphragm - D -vertebral column

(D) A-vertebral column, B-sternum, C-ribs, D-diaphragm

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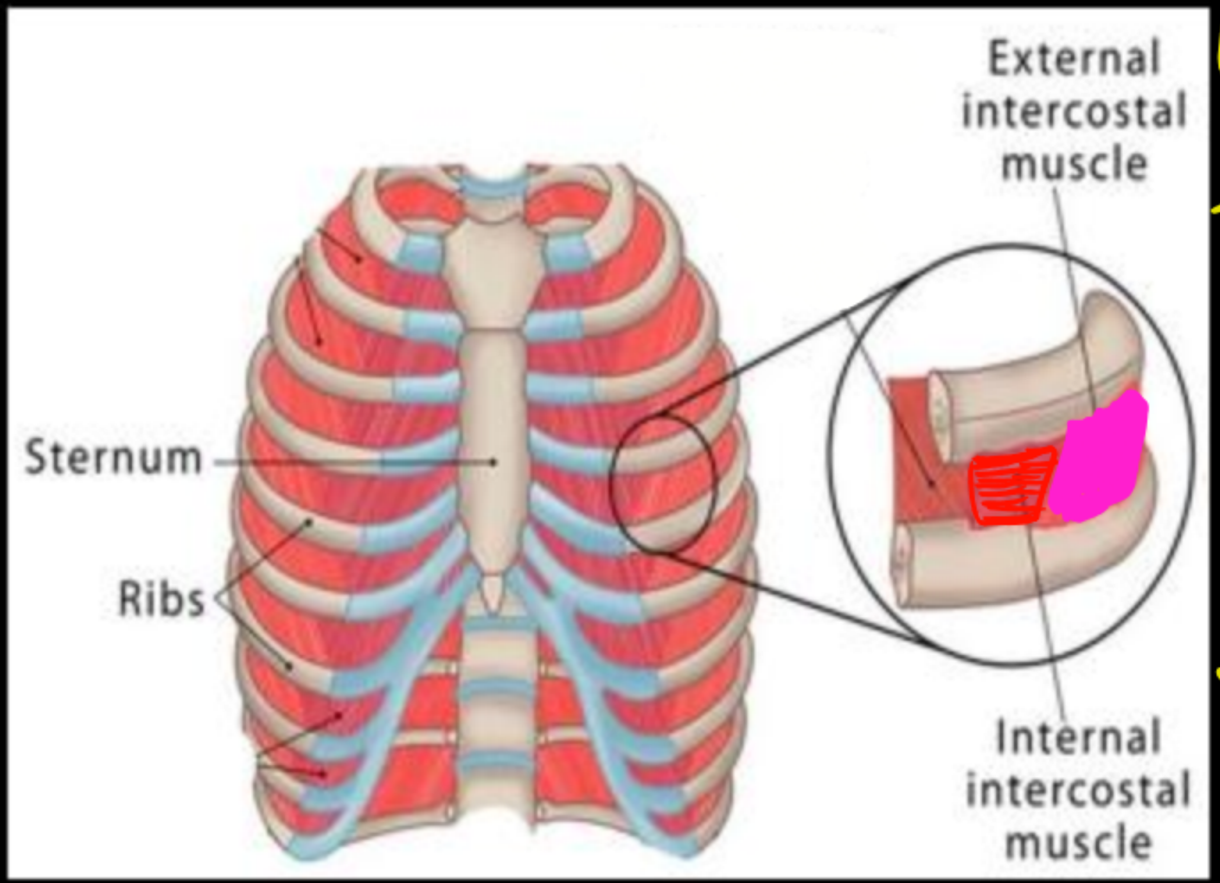
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Mechanism of Breathing

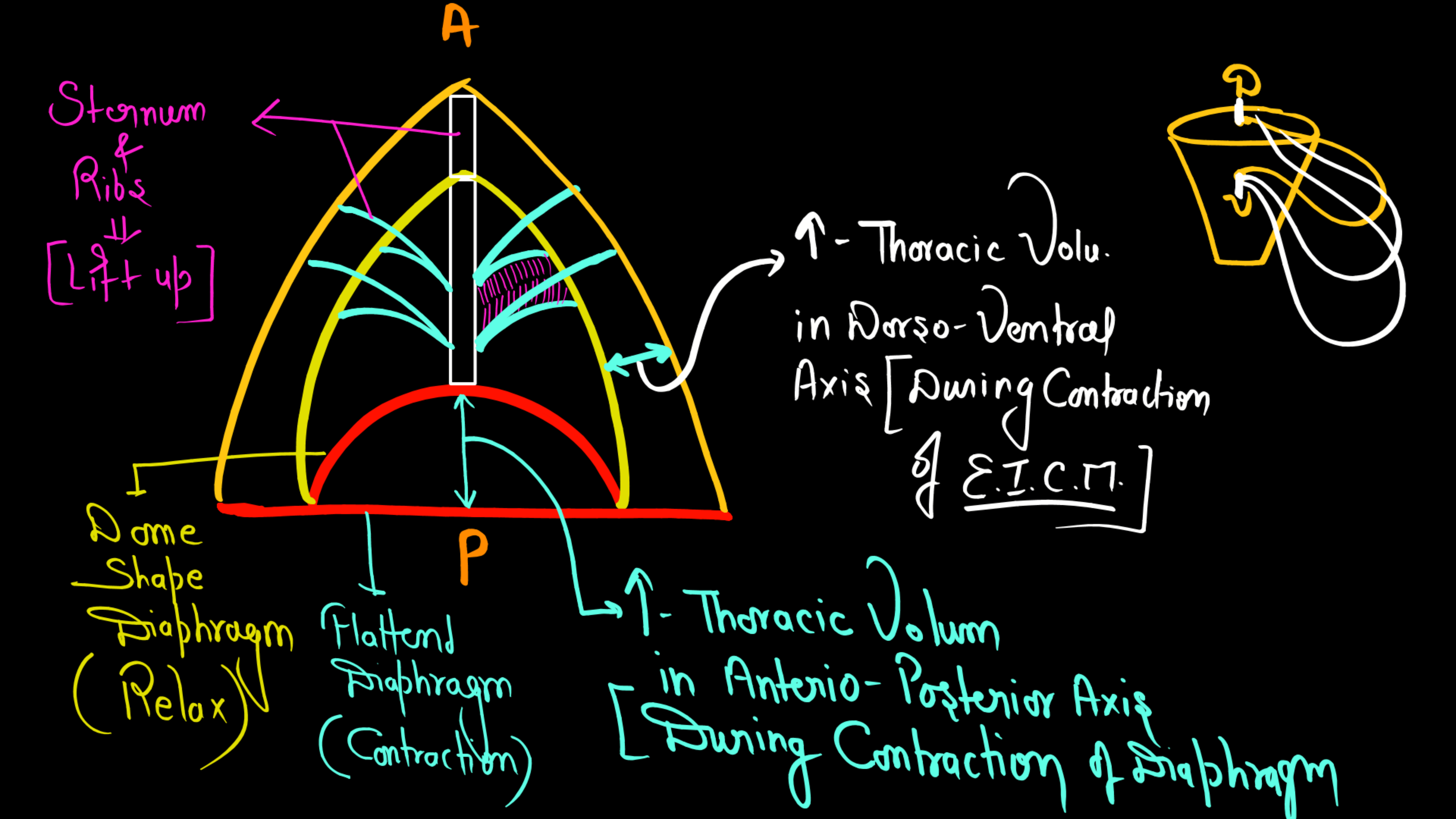
It is alternate contract and relaxation of mainly two types of muscle-

- Diaphragm muscle/Phrenic muscle
- Intercostal muscle



EICM → Normal Breathing
- Contract = ↑ - Thoracic Volu.
- Relax = ↓ - Thoracic Volu.

IICM → Forceful Breathing
- Contract = ↓ - Thoracic Volu.
- Relax = ↑ Thoracic Volu.


A
Sternum & Ribs
⇓
[Lift up]
↑ - Thoracic Volu. in Dorso-Ventral Axis [During Contraction of E.I.C.M.]
Dome Shape Diaphragm (Relax)
P
Flattend Diaphragm (Contraction)
↑ - Thoracic Volum in Anterio-Posterior Axis [During Contraction of Diaphragm]

Inspiration (Active)

1) - Contraction in Diaphragm
[↑ Thoracic Volu. in A-P axis]

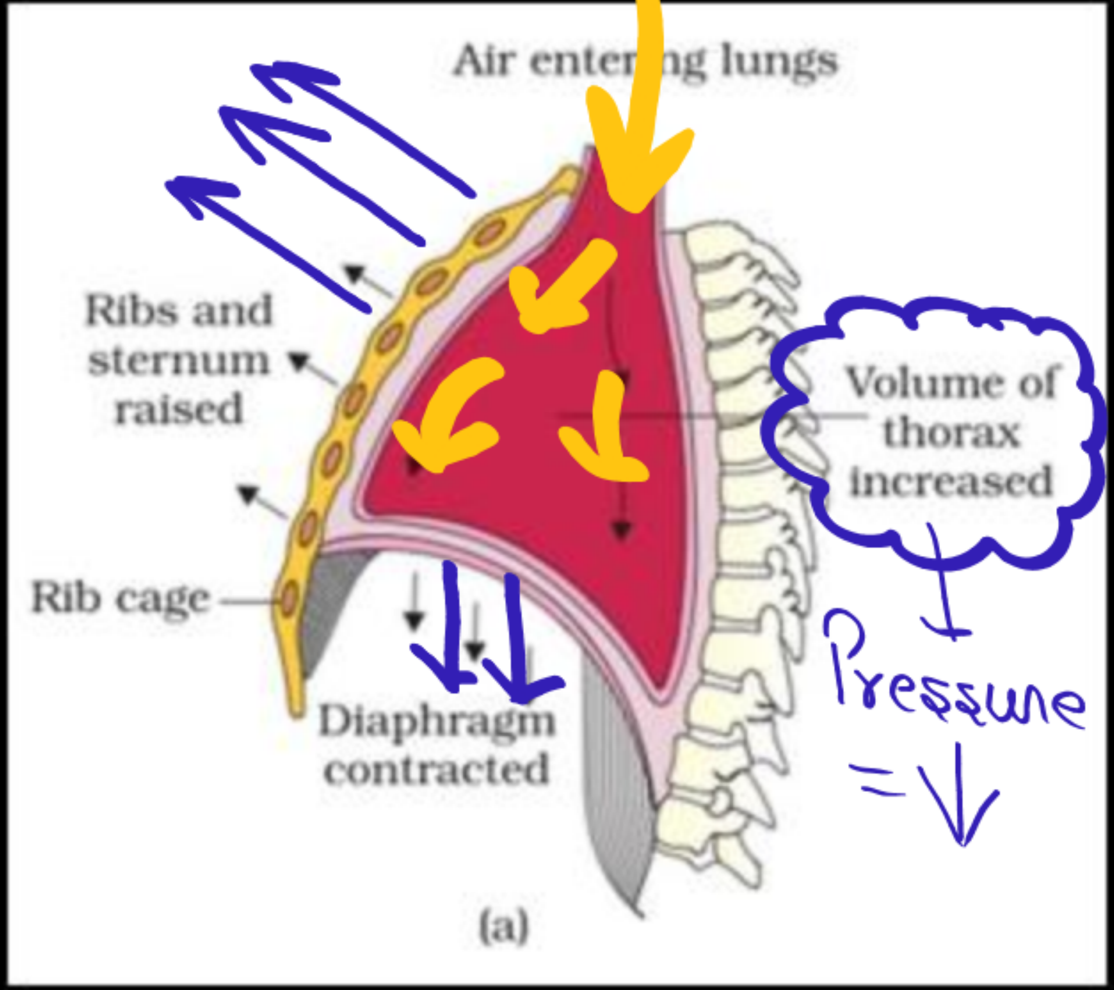
2) - Contraction in E.I.C.M. (Lift up < Ribs, Sternum)
[↑ - Thoracic Volu. in D-V. axis]

⇓

[↓ = Intra pulmonary Pressure]

⇓

(Atm. Air enter in lungs)



Expiration (Passive)

Relaxation of Diaphragm Mus.

[↓ - Thoracic Volu. in A-P axis]

Relaxation of E.I.C.M.

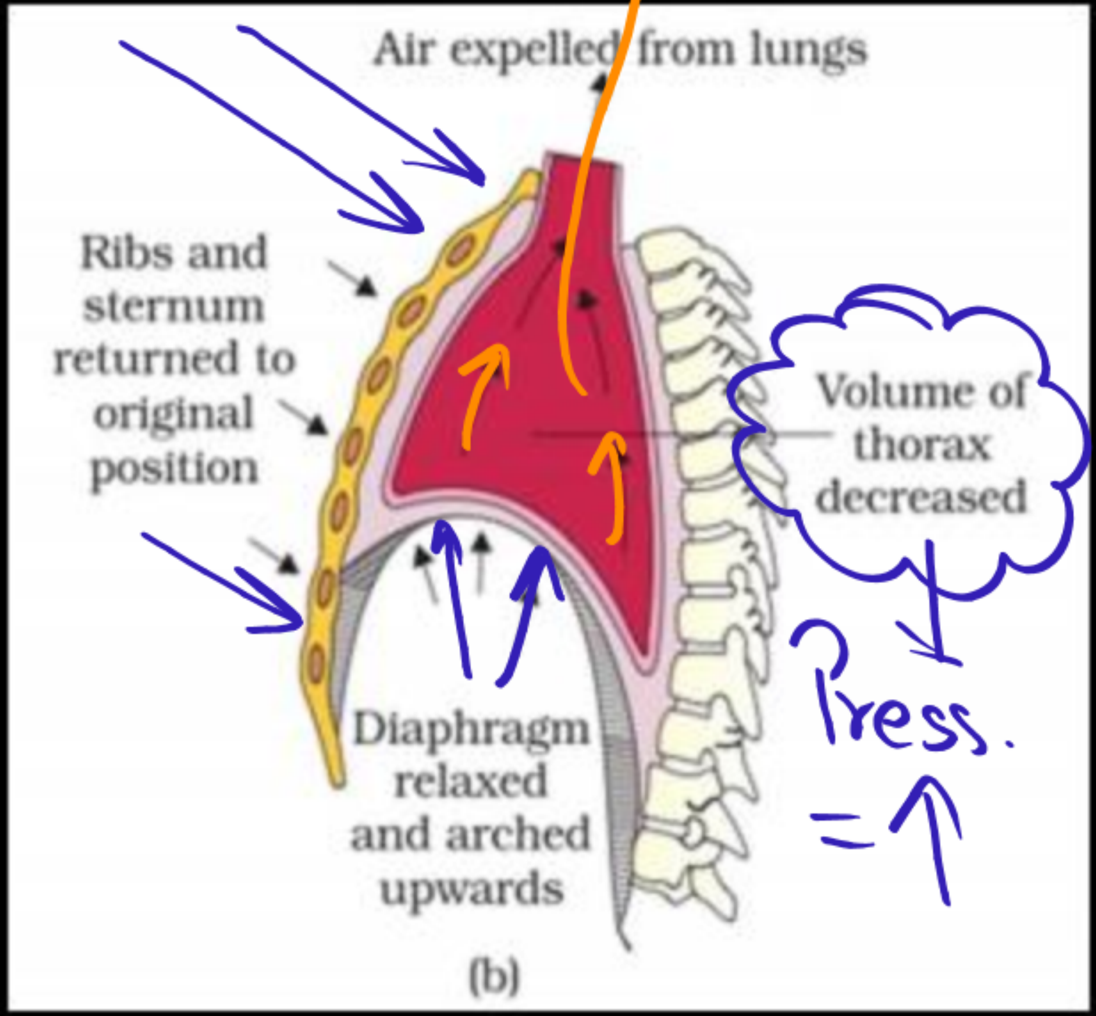
[↓ - Thoracic Volu. in D-V axis]

⇓

[↑ - Intra-pulmonary pressure]

⇓

Flow of Air ⇒ lungs to Atm.

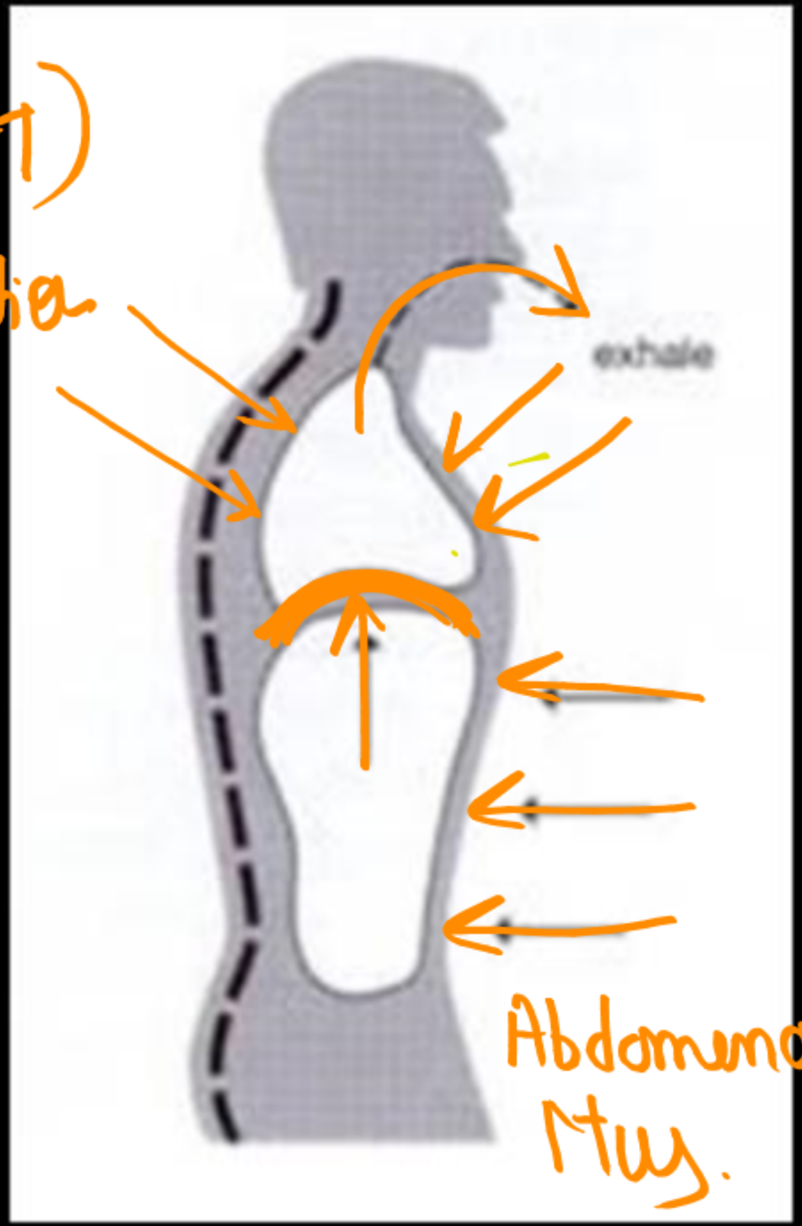


Forced Expiration

→ F. Expira. = Contraction = A
→ F. Inspiration = Relaxation = P

{ Internal Intercostal Mus + Abdominal Mus. } → Contraction

[↓↓ Thoracic Volume]
⇓
[↑ = Intra-pulmonary Pressure]
⇓
Forced Expiration



Types of Breathing -

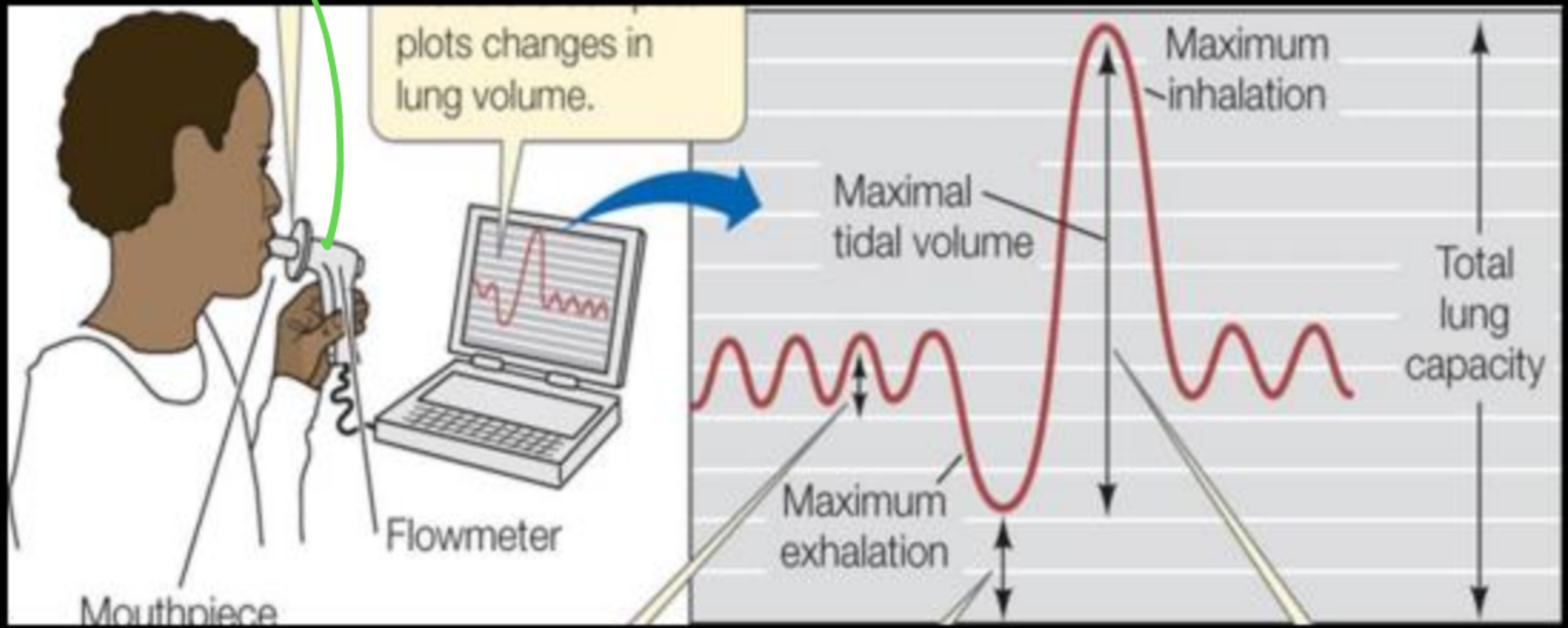
- Conscious Breathing (25-30%) = Intercostal Muscles, Diaphragm Mus.
  - ⇓
  - Regulation = Cerebrum
- Unconscious Breathing (70-75%) = Diaphragm Mus.
  - ⇓
  - Regulation = Medulla oblongata (M.O.)

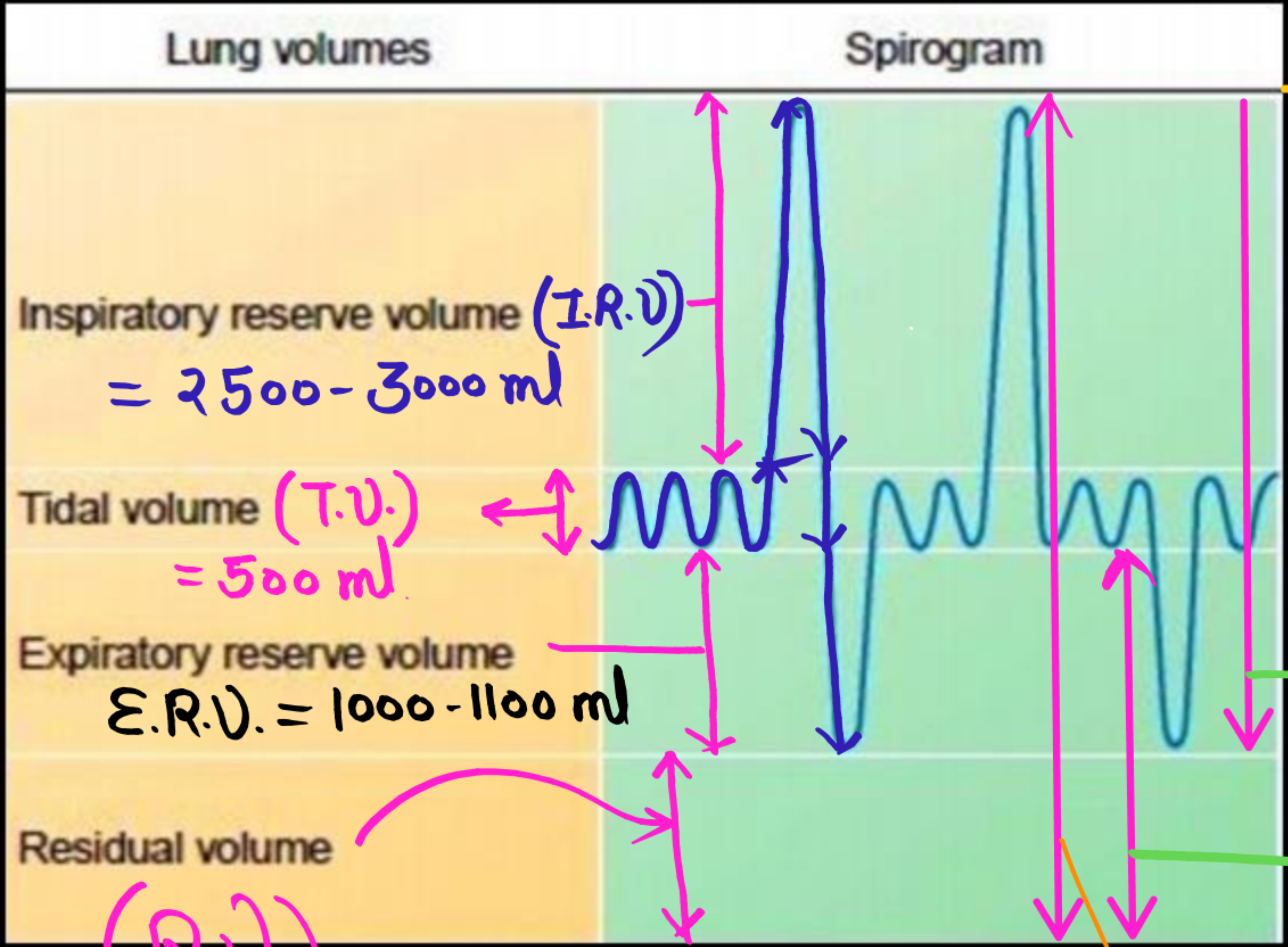
Respiratory Volumes and Capacities

- On an average, a healthy human breathes 12-16 times/minute.

Spirometer

Spirogram





(R.V) = 1100–1200 ml

lung Capacities

I.C. = T.V. + I.R.V = 3500 ml
or [T.L.C – F.R.C]

E.C. = T.V. + E.R.V = 1600 ml
or [VC – IRV]

V.C. = T.V + IRV + ERV
= 4600 ml

F.R.C. = E.R.V. + R.V

T.L.C. = T.V + IRV + ERV + R.V
or [VC + RV]

Note –

- Spirometry cannot be used to measure the residual volume or any capacities which incorporate the residual volume such as functional residual capacity (FRC) and total lung capacity (TLC).

- **Pulmonary Ventilation -** Rate = Time

P.V.R. = T.V × 12–16

= 500 × [12–16] = 6000 – 8000 ml / minute

or

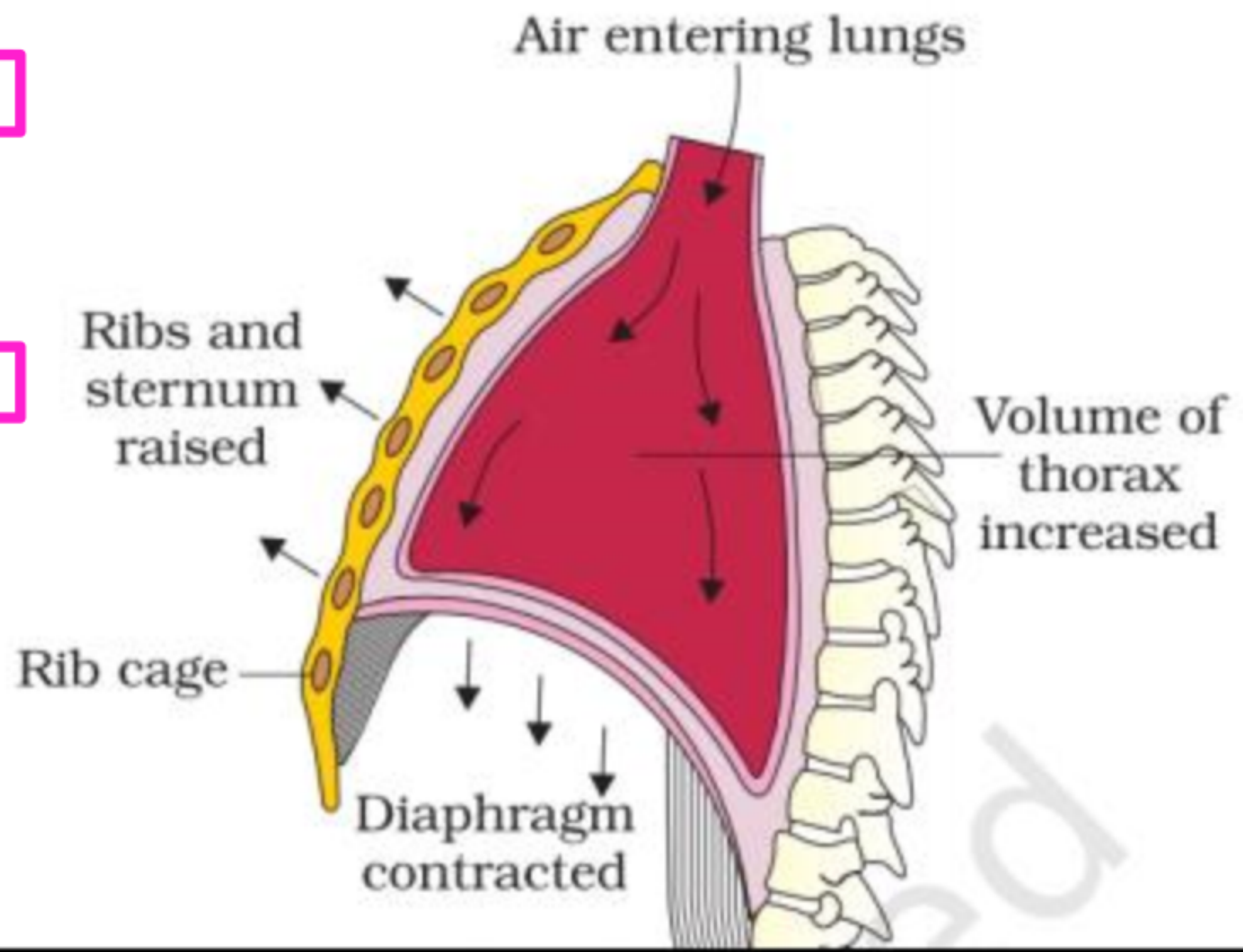
6 – 8 L / minute.

17.2 Mechanism of Breathing

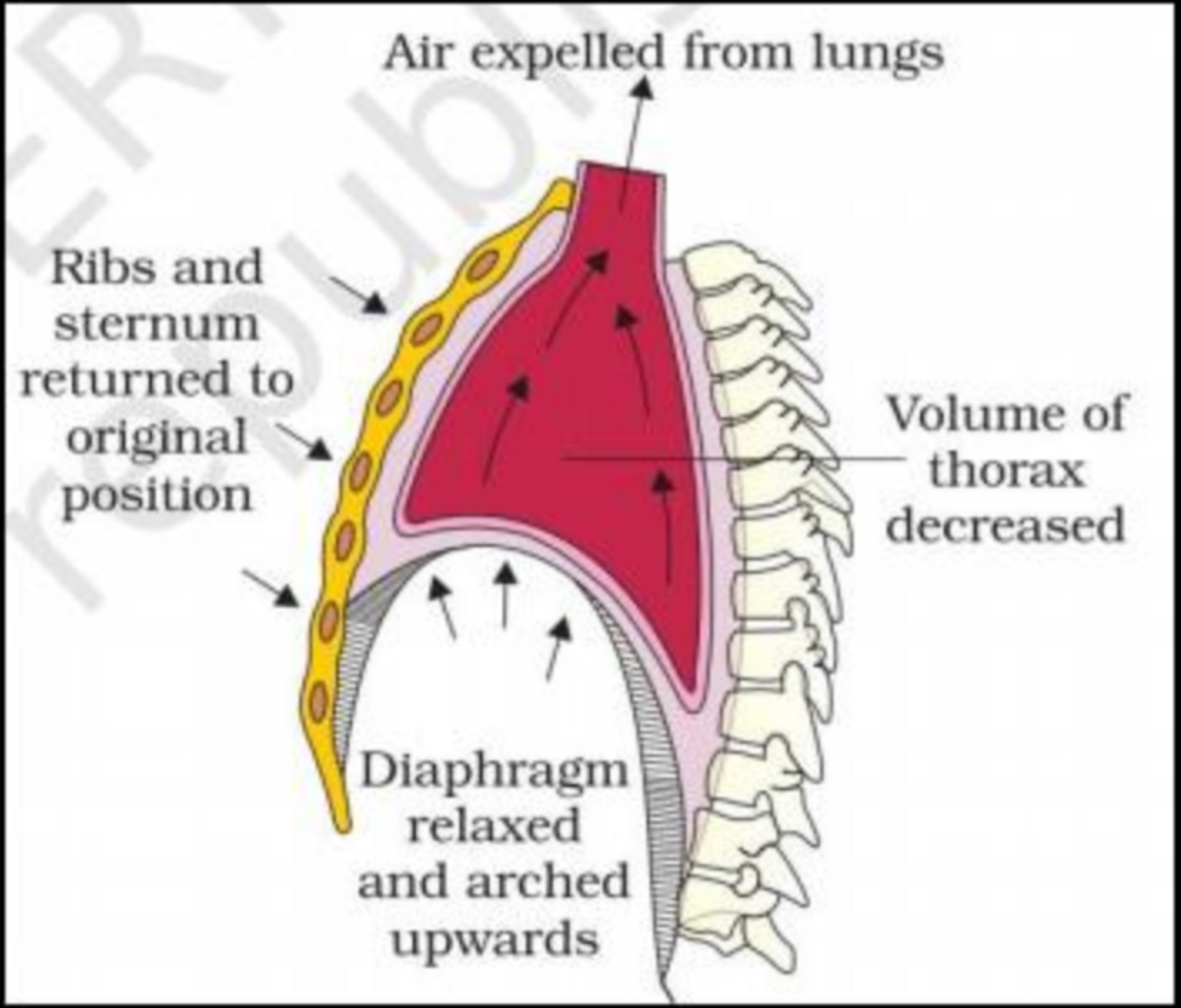
Breathing involves two stages : **inspiration** during which atmospheric air is drawn in and **expiration** by which the alveolar air is released out. The movement of air into and out of the lungs is carried out by creating a pressure gradient between the lungs and the atmosphere. Inspiration can occur if the pressure within the lungs (intra-pulmonary pressure) is less than the atmospheric pressure, i.e., there is a negative pressure in the lungs with respect to atmospheric pressure. Similarly, expiration takes

the lungs with respect to atmospheric pressure. Similarly, expiration takes place when the intra-pulmonary pressure is higher than the atmospheric pressure. The diaphragm and a specialised set of muscles – external and internal intercostals between the ribs, help in generation of such gradients. Inspiration is initiated by the contraction of diaphragm which increases the volume of thoracic chamber in the antero-posterior axis. The contraction of external inter-costal muscles lifts up the ribs and the

sternum causing an increase in the volume of the thoracic chamber in the dorso-ventral axis. The overall increase in the thoracic volume causes a similar increase in pulmonary volume. An increase in pulmonary volume decreases the intra-pulmonary pressure to less than the atmospheric pressure which forces the air from outside to move into the lungs, i.e., inspiration (Figure 17.2a). Relaxation of the diaphragm and the inter-costal muscles returns the diaphragm and sternum to their normal positions and reduce the thoracic volume and thereby the pulmonary volume.



This leads to an increase in intra-pulmonary pressure to slightly above the atmospheric pressure causing the expulsion of air from the lungs, i.e., expiration (Figure 17.2b). We have the ability to increase the strength of inspiration and expiration with the help of additional muscles in the abdomen. On an average, a healthy human breathes 12-16 times/minute. The volume of air involved in breathing movements can be estimated by using a spirometer which helps in clinical assessment of pulmonary functions.



17.2.1 Respiratory Volumes and Capacities

Tidal Volume (TV): Volume of air inspired or expired during a normal respiration. It is approx. 500 mL., i.e., a healthy man can inspire or expire approximately 6000 to 8000 mL of air per minute.

Inspiratory Reserve Volume (IRV): Additional volume of air, a person can inspire by a forcible inspiration. This averages 2500 mL to 3000 mL.

Expiratory Reserve Volume (ERV): Additional volume of air, a person can expire by a forcible expiration. This averages 1000 mL to 1100 mL.

Residual Volume (RV): Volume of air remaining in the lungs even after a forcible expiration. This averages 1100 mL to 1200 mL.

By adding up a few respiratory volumes described above, one can derive various pulmonary capacities, which can be used in clinical diagnosis.

Inspiratory Capacity (IC): Total volume of air a person can inspire after a normal expiration. This includes tidal volume and inspiratory reserve volume (TV+IRV).

Expiratory Capacity (EC): Total volume of air a person can expire after a normal inspiration. This includes tidal volume and expiratory reserve volume (TV+ERV).

Functional Residual Capacity (FRC): Volume of air that will remain in the lungs after a normal expiration. This includes ERV+RV.

Vital Capacity (VC): The maximum volume of air a person can breathe in after a forced expiration. This includes ERV, TV and IRV or the maximum volume of air a person can breathe out after a forced inspiration.

Total Lung Capacity (TLC): Total volume of air accommodated in the lungs at the end of a forced inspiration. This includes RV, ERV, TV and IRV or vital capacity + residual volume.

(H.W.)

1. The maximum volume of air you can forcefully exhale after taking the deepest possible breath is called.

(A) Tidal volume

(B) Total respiratory volume

(C) Residual volume

(D) Vital capacity

2. Expiration occurs due to

(A) Relaxation of diaphragm and external inter-costal muscle

(B) Contraction of internal intercostal muscles and diaphragm

(C) Relaxation of abdominal and internal inter-costal muscles

(D) Contraction of diaphragm and relaxation of abdominal muscles

3. Arrange the following in order of increasing volume –

1. Tidal volume
2. Residual volume
3. Expiratory reserve volume
4. Vital capacity

(A) 1 < 2 < 3 < 4 (B) 1 < 4 < 3 < 2

(C) 1 < 3 < 2 < 4 (D) 1 < 4 < 2 < 3

4. Expiratory capacity is equal to –

(A) TV+ ERV (B) ERV+ IRV

(C) ERV+ RV (D) ERV+ RV

5. Which of the following factors affect the diffusion of gases?

(A) Partial pressure of diffusing gases
(C) Solubility of gases
(C) The thickness of diffusion membrane
(D) All

6. Vital capacity of our lungs is
(1) Total lungs capacity minus residual volume
(2) Inspiratory reserve volume plus tidal volume
(3) Total lungs capacity minus expiratory reserve volume
(4) Inspiratory reserve volume plus expiratory reserve volume

7. During oxygen transport, the oxyhaemoglobin at the tissue level liberates oxygen to the cells because

(1) O2 concentration is high and CO2 is low
(2) O2 concentration is low and CO2 is high
(3) O2 tension is low and CO2 tension is high
(4) O2 tension is high and CO2 tension is low

8. Breathing involves ...A... during which atmospheric air is drawn in and ...B... by which the alveolar air is released out.

Choose the correct option for A and B to complete the given NCERT statement.

(1) A-expiration; B-osmosis
(2) A-expiration; B-inspiration
(3) A-inspiration; B-expiration
(4) A-inspiration; B-diffusion

9 Which of the following volume is not included in vital capacity?

(1) ERV (2) TV

(3) IRV (4) RV

10 The breathing rate of a normal healthy man is

(1) 8–18 times/min (2) 6–12 times/min

(3) 16–24 times/min (4) 12–16 times/min

11 Value of tidal volume in a normal healthy man is

(1) 6000–8000 ml/min

(2) 1000–1100 ml/min

(3) 2500–3000 ml/min

(4) 8000–12000 ml/min

Think Positively and Positive Things Will Happen

THANK YOU

MANTHAN NEET 2025

Breathing and Exchange of Gases

LECTURE -4

ZOOLOGY

MD SIR



TODAY'S GOAL

Exchange of Gases

Transport of Gases

1. The maximum volume of air you can forcefully exhale after taking the deepest possible breath is called.

(A) Tidal volume

(B) Total respiratory volume

(C) Residual volume

(D) Vital capacity

2. Expiration occurs due to

(A) Relaxation of diaphragm and external inter-costal muscle

(B) Contraction of internal intercostal muscles and diaphragm

(C) Relaxation of abdominal and internal inter-costal muscles

(D) Contraction of diaphragm and relaxation of abdominal muscles

Which of the following factors affect the diffusion of gases?

(A) Partial pressure of diffusing gases
(C) Solubility of gases
(C) The thickness of diffusion membrane
(D) All

Vital capacity of our lungs is

(1) Total lungs capacity minus residual volume
(2) Inspiratory reserve volume plus tidal volume
(3) Total lungs capacity minus expiratory reserve volume
(4) Inspiratory reserve volume plus expiratory reserve volume

Arrange the following in order of increasing volume –

1. Tidal volume
2. Residual volume
3. Expiratory reserve volume
4. Vital capacity

(A) 1 < 2 < 3 < 4
(B) 1 < 4 < 3 < 2
(C) 1 < 3 < 2 < 4
(D) 1 < 4 < 2 < 3

Expiratory capacity is equal to –

(A) TV+ ERV
(B) ERV+ IRV
(C) ERV+ RV
(D) ERV+ RV

7. During oxygen transport, the oxyhaemoglobin at the tissue level liberates oxygen to the cells because

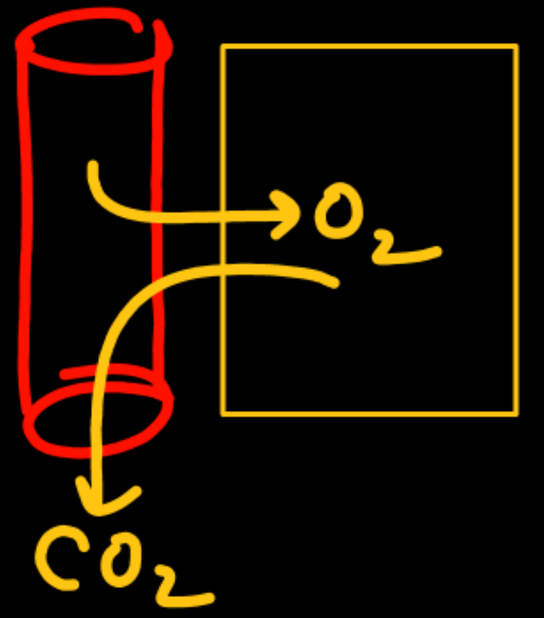
(1) O_2 concentration is high and CO_2 is low

(2) O_2 concentration is low and CO_2 is high

(3) O_2 tension is low and CO_2 tension is high

(4) O_2 tension is high and CO_2 tension is low

2



8. Breathing involves ...A... during which atmospheric air is drawn in and ...B... by which the alveolar air is released out.

Choose the correct option for A and B to complete the given NCERT statement.

(1) A-expiration; B-osmosis

(2) A-expiration; B-inspiration

(3) A-inspiration; B-expiration

(4) A-inspiration; B-diffusion

3

9 Which of the following volume is not included in vital capacity?

(1) ERV (2) TV

(3) IRV (4) RV

10 The breathing rate of a normal healthy man is

(1) 8–18 times/min (2) 6–12 times/min

(3) 16–24 times/min (4) 12–16 times/min

11 Value of tidal volume in a normal healthy man is

(1) 6000–8000 ml/min

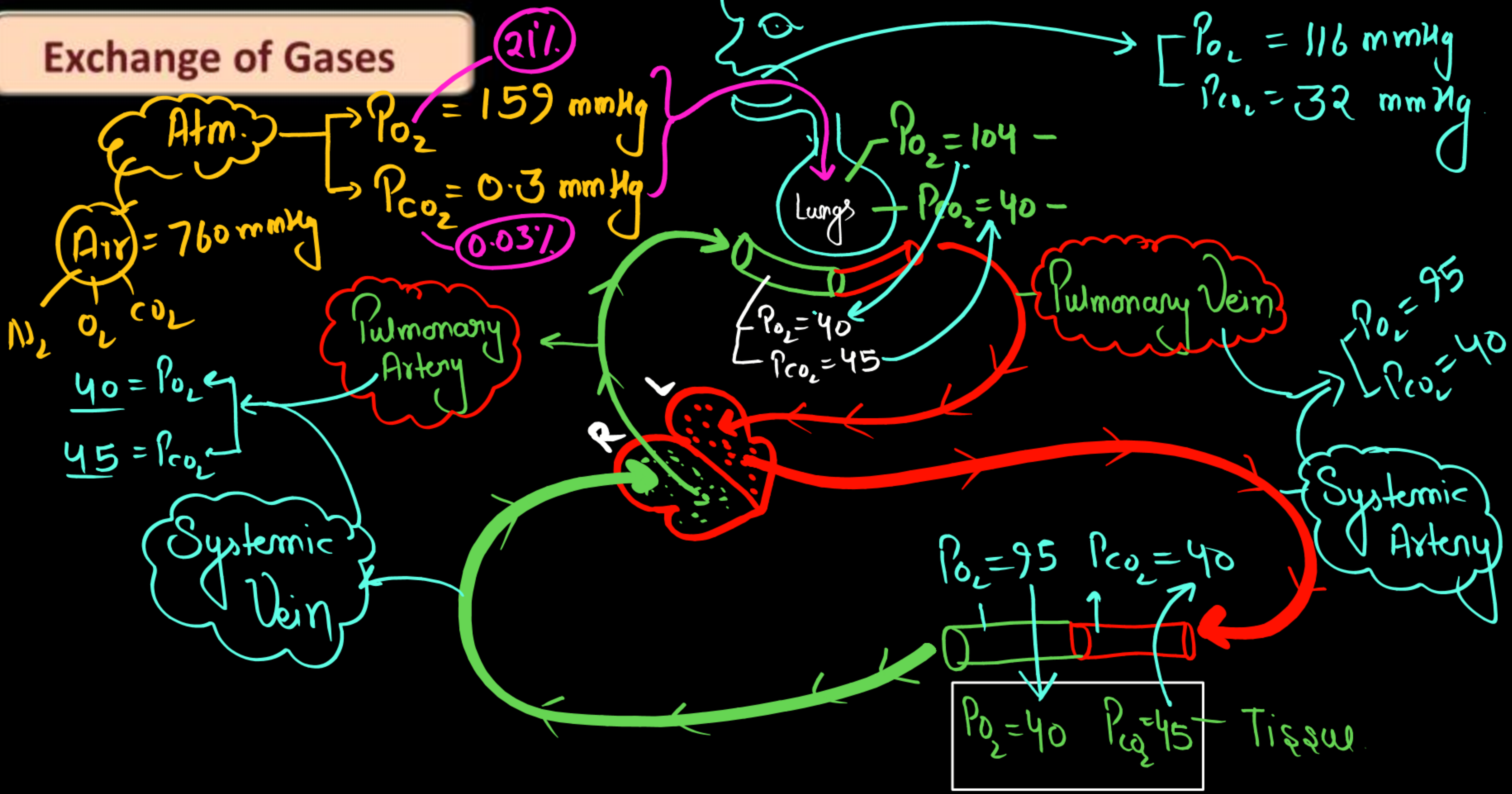
(2) 1000–1100 ml/min

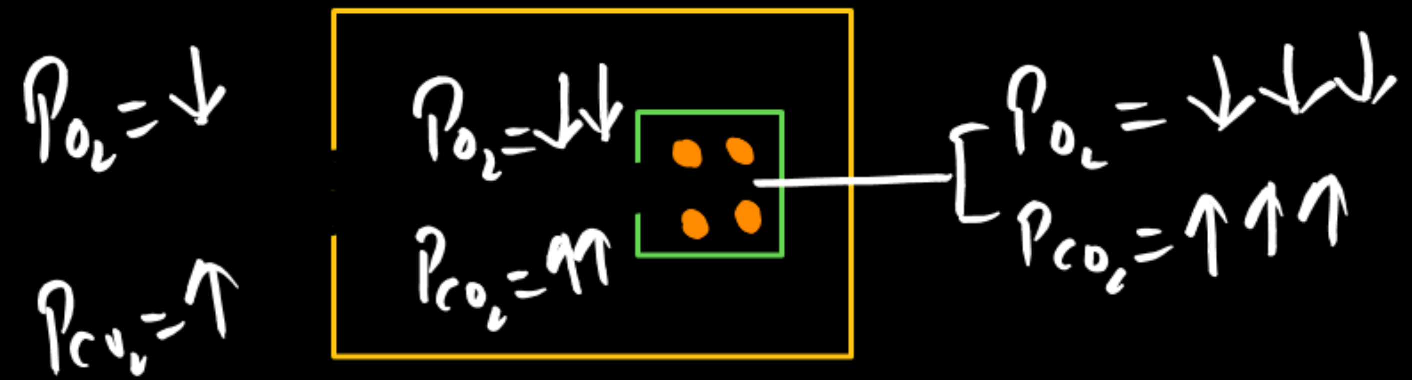
(3) 2500–3000 ml/min

(4) 8000–12000 ml/min

1

Exchange of Gases





V. Imp

P_{O_2} = Atm. (159) → lung (104) → oxy. blood (95) → Tissue (40) (Utilization of O_2)

P_{CO_2} = Tissue (45) → Deoxy. blood (45) → lungs (40) → Expired Air (32) → Atm. (0.3)

TABLE 17.1 Partial Pressures (in mm Hg) of Oxygen and Carbon dioxide at Different Parts Involved in Diffusion in Comparison to those in Atmosphere

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

Transport of Gases

[Transport of O_2]

1) → 2-3% = Through Plasma
[O_2 less Soluble in Plasma]

2) → 97-98% = Through H.b./R.B.C

[Transport of CO_2]

→ 7% = Dissolved in plasma (CO_2)

→ 70% = Bicarbonate ions (HCO_3^-) } through Plasma

} Through Plasma 77%

(20-25% more Soluble in Plasma.)

→ 23% = Hb/R.B.C } Carbaminohaemoglobin ($Hb-CO_2$)

Note ⇒ Haemoglobin (H.b.)

- → O_2 = Oxyhaemoglobin ($Hb\text{-}O_2$)
- → CO_2 = Carbaminohaemoglobin ($Hb\text{-}CO_2$)

} → Reversible Binding

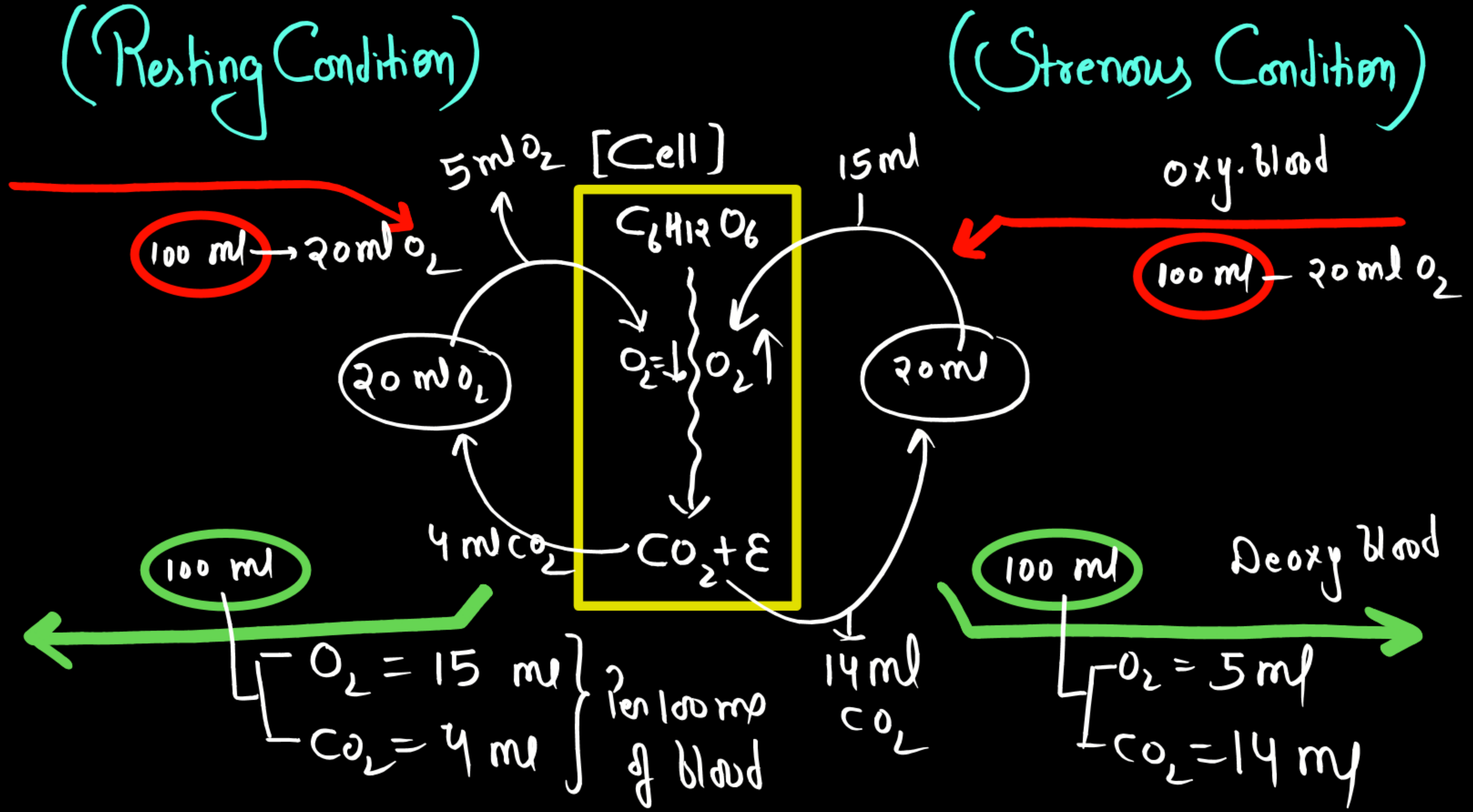
- → CO = Carboxyhaemoglobin

[Irreversible Binding]

Amount of transport of O_2 and CO_2 during resting and strenuous exercise

In a Healthy Human

- Per 100 ml of blood contain 15 gm Hb
- 1 gm Hb carry 1.34 ml O_2
- 15 gm Hb carry 1.34 x 15 ml = 20 ml O_2
- Per 100 ml of Oxygenated blood carry 20 ml O_2



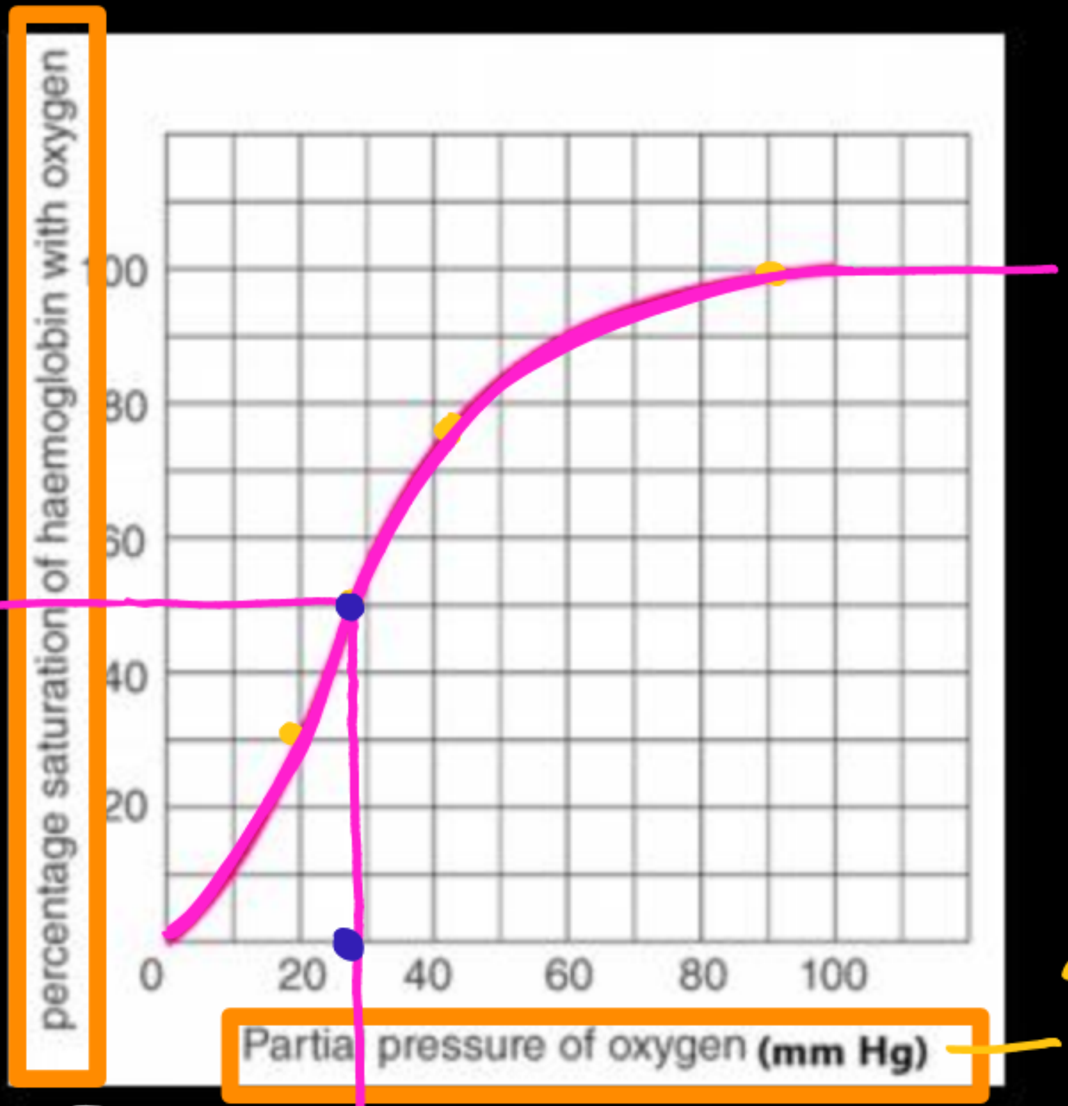
(Resting Condition)
(Strenous Condition)
5ml O2
[Cell]
15ml
oxy. blood
100 ml → 20ml O2
C6H12O6
100 ml — 20ml O2
O2 ↓ O2 ↑
20 ml O2
20ml
4 ml CO2
CO2 + E
100 ml
Deoxy blood
100 ml
O2 = 15 ml
CO2 = 4 ml
Per 100 ml of blood
14ml CO2
O2 = 5ml
CO2 = 14 ml

Oxygen Haemoglobin Dissociation Curve

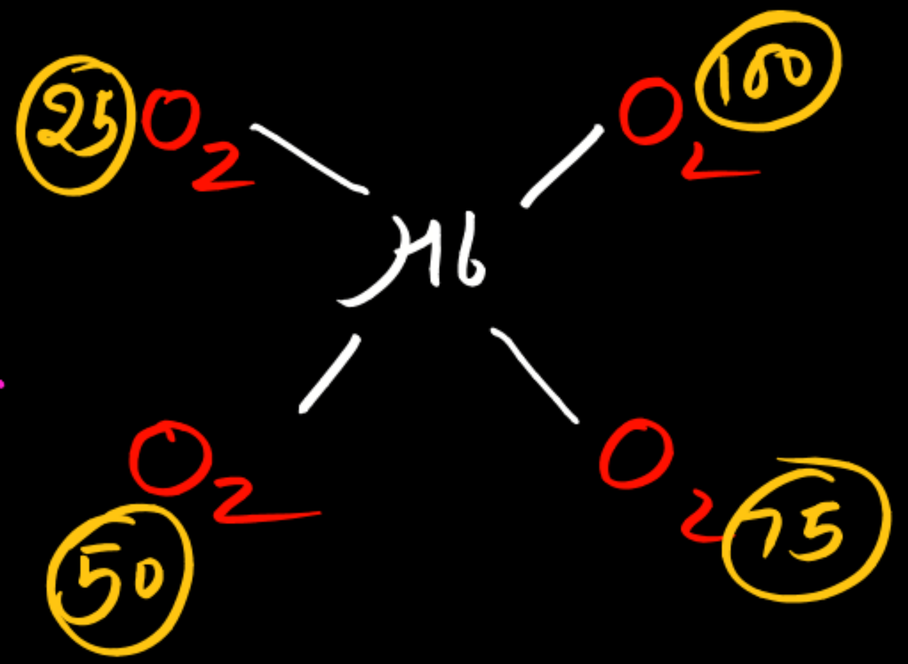
Sigmoid Curve / Bohr's Effect

S-Shape

% Saturation of Hb-O_2



Partial Pressure of O_2



P_{50}-Value = Partial Pressure of O_2 at 50% Hb-O_2 Saturated

26 mmHg

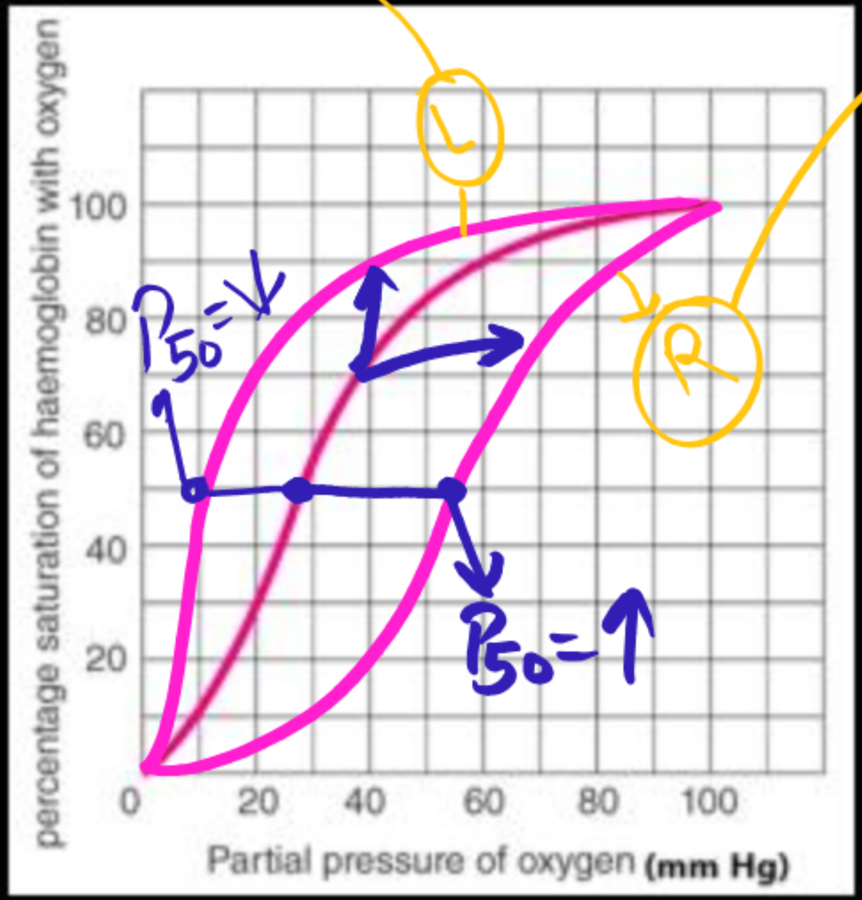
[Left Shift]

[Favourable Condition]

→ $Hb\text{-}O_2$ Association

(Haldane Effect)

- $P_{O_2} = \uparrow$ & $P_{CO_2} = \downarrow$
- $H^+ = \downarrow$ & $PH = \uparrow$
- $P_{50} = \downarrow$
- Temp. = ↓
- Near Lungs.



[Right Shift]

[Unfavourable Condition]

→ $Hb\text{-}O_2$ = Dissociation

(Bohr Effect)

- $P_{O_2} = \downarrow$ & $P_{CO_2} = \uparrow$
- $H^+ = \uparrow$ & $PH = \downarrow$
- $P_{50} = \uparrow$
- Temp. = ↑
- Near Tissue

17.3 Exchange of Gases

Alveoli are the primary sites of exchange of gases. Exchange of gases also occur between blood and tissues. O_2 and CO_2 are exchanged in these sites by simple diffusion mainly based on pressure/concentration gradient. Solubility of the gases as well as the thickness of the membranes involved in diffusion are also some important factors that can affect the rate of diffusion.

Pressure contributed by an individual gas in a mixture of gases is called partial pressure and is represented as pO_2 for oxygen and pCO_2 for carbon dioxide. Partial pressures of these two gases in the atmospheric air and the two sites of diffusion are given in Table 17.1 and in Figure 17.3. The data given in the table clearly indicates a concentration gradient for oxygen from alveoli to blood and blood to tissues. Similarly,

a gradient is present for CO_2 in the opposite direction, i.e., from tissues to blood and blood to alveoli. As the solubility of CO_2 is 20-25 times higher than that of O_2, the amount of CO_2 that can diffuse through the diffusion membrane per unit difference in partial pressure is much higher compared to that of O_2. The diffusion membrane is made up of three major layers (Figure 17.4) namely, the thin squamous epithelium of alveoli, the endothelium of alveolar capillaries and the basement substance (composed of a thin basement membrane supporting the squamous epithelium and the basement membrane surrounding the single layer endothelial cells of capillaries) in between them. However, its total thickness is much less than a millimetre. Therefore, all the factors in our body are favourable for diffusion of O_2 from alveoli to tissues and that of CO_2 from tissues to alveoli.

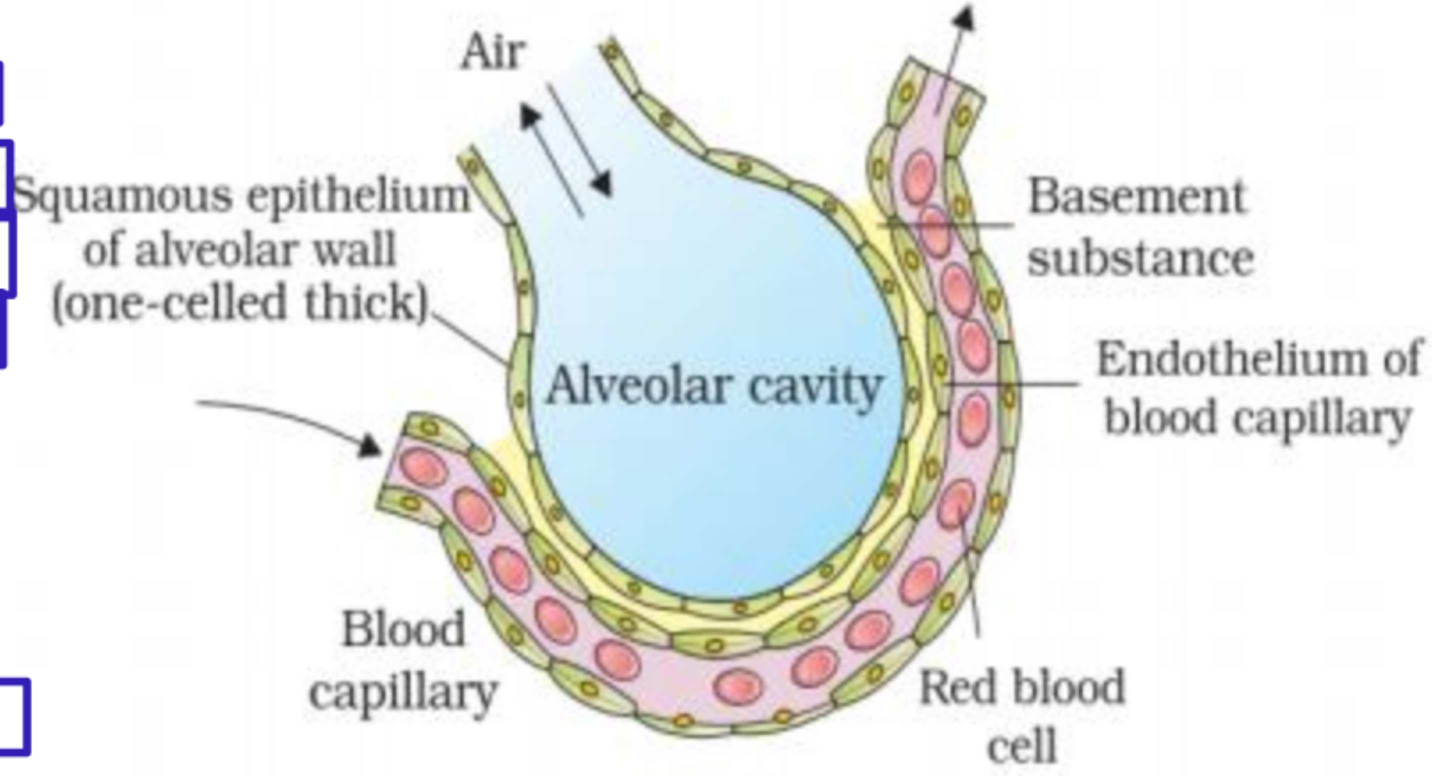
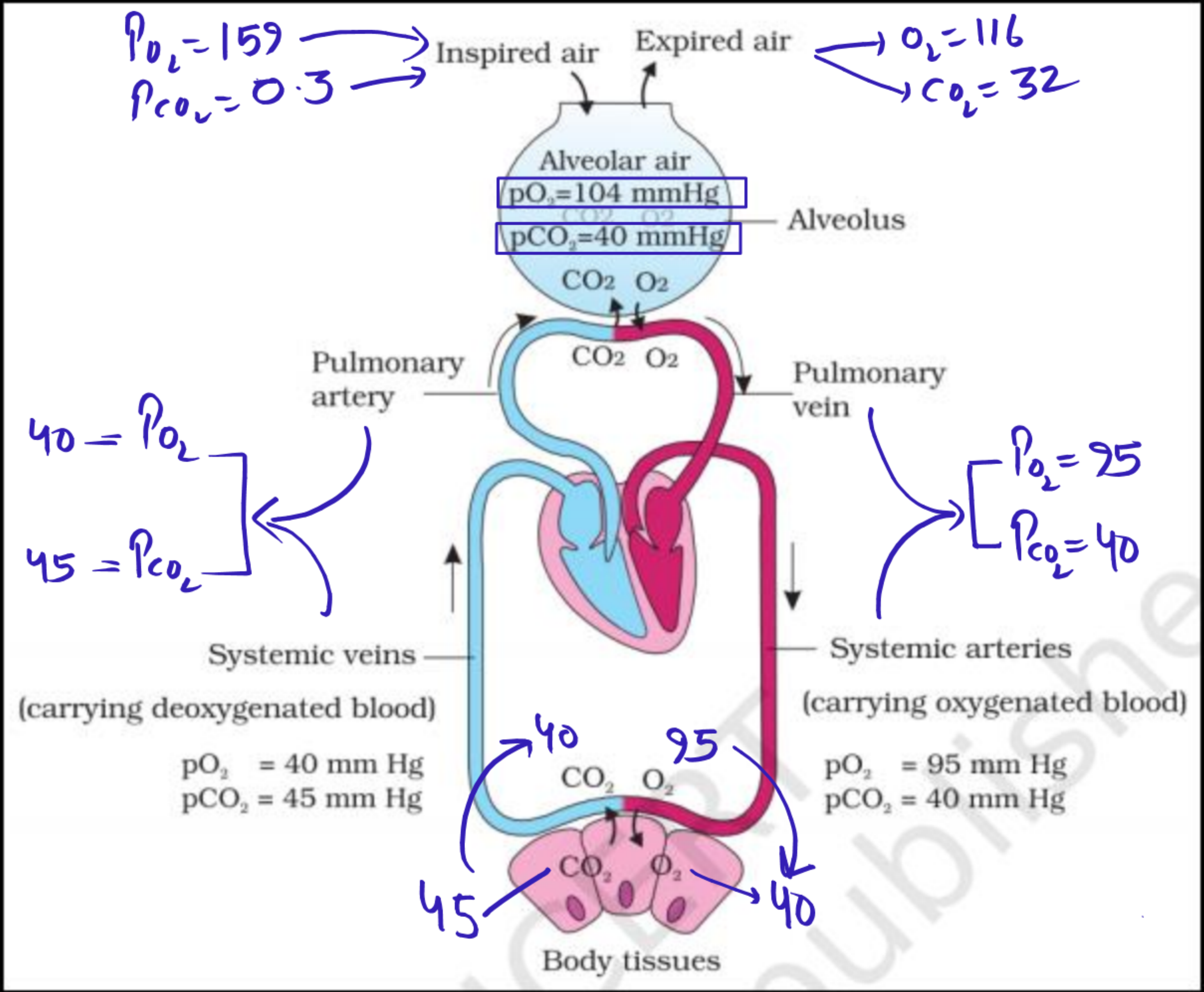


Figure 17.4 A Diagram of a section of an alveolus with a pulmonary capillary.



Inspired air
Expired air
Alveolar air
pO2=104 mmHg
pCO2=40 mmHg
Alveolus
CO2 O2
CO2 O2
Pulmonary artery
Pulmonary vein
Systemic veins
(carrying deoxygenated blood)
pO2 = 40 mm Hg
pCO2 = 45 mm Hg
Systemic arteries
(carrying oxygenated blood)
pO2 = 95 mm Hg
pCO2 = 40 mm Hg
CO2 O2
CO2 O2
Body tissues
PO2 = 159
PCO2 = 0.3
O2 = 116
CO2 = 32
40 = PO2
45 = PCO2
PO2 = 95
PCO2 = 40
40
95
45
40

TABLE 17.1 Partial Pressures (in mm Hg) of Oxygen and Carbon dioxide at Different Parts Involved in Diffusion in Comparison to those in Atmosphere

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

17.4 Transport of Gases

Blood is the medium of transport for O_2 and CO_2. About 97 per cent of O_2 is transported by RBCs in the blood. The remaining 3 per cent of O_2 is carried in a dissolved state through the plasma. Nearly 20-25 per cent of CO_2 is transported by RBCs whereas 70 per cent of it is carried as bicarbonate. About 7 per cent of CO_2 is carried in a dissolved state through plasma.

17.4.1 Transport of Oxygen

Haemoglobin is a red coloured iron containing pigment present in the RBCs. O_2 can bind with haemoglobin in a reversible manner to form **oxyhaemoglobin**. Each haemoglobin molecule can carry a maximum of four molecules of O_2. Binding of oxygen with haemoglobin is primarily related to partial pressure of O_2. Partial pressure of CO_2, hydrogen ion concentration and temperature are the other factors which can interfere with this binding. A sigmoid curve is obtained when percentage saturation

of haemoglobin with O_2 is plotted against the pO_2. This curve is called the Oxygen dissociation curve (Figure 17.5) and is highly useful in studying the effect of factors like pCO_2, H^+ concentration, etc. on binding of O_2 with haemoglobin. In the alveoli, where there is high pO_2, low pCO_2, lesser H^+ concentration and lower temperature, the factors are all favourable for the formation of oxyhaemoglobin, whereas in the tissues, where low pO_2, high pCO_2, high H^+ concentration and higher temperature exist, the conditions are favourable for dissociation of oxygen from the oxyhaemoglobin. This clearly indicates that O_2 gets bound to haemoglobin in the lung surface and gets dissociated at the tissues. Every 100 ml of oxygenated blood can deliver around 5 ml of O_2 to the tissues under normal physiological conditions.

}Resting Condition

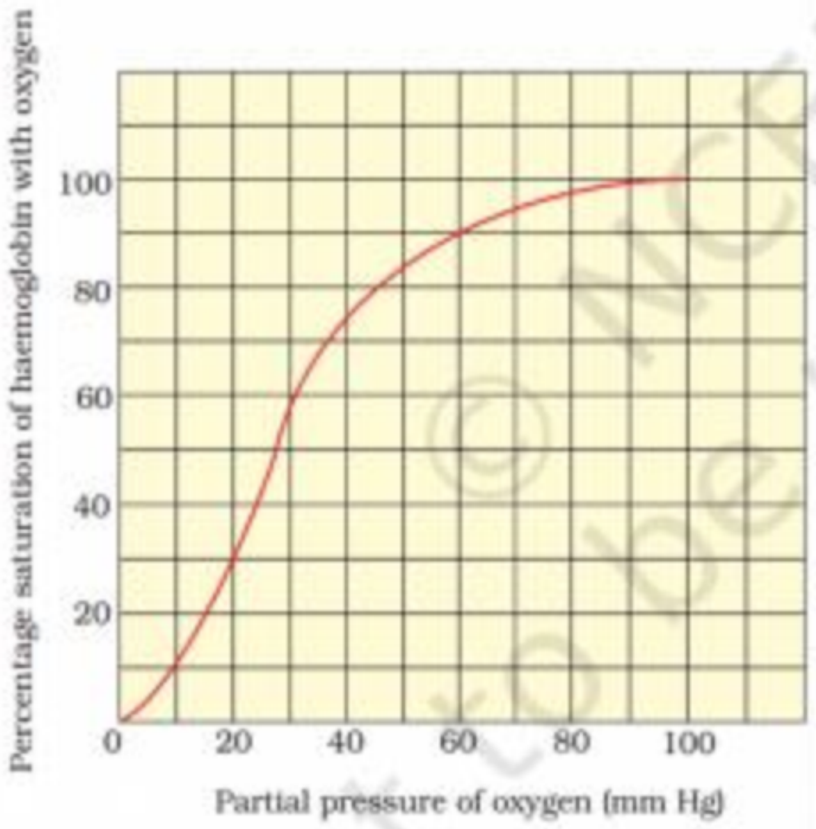


Figure 17.5 Oxygen dissociation curve

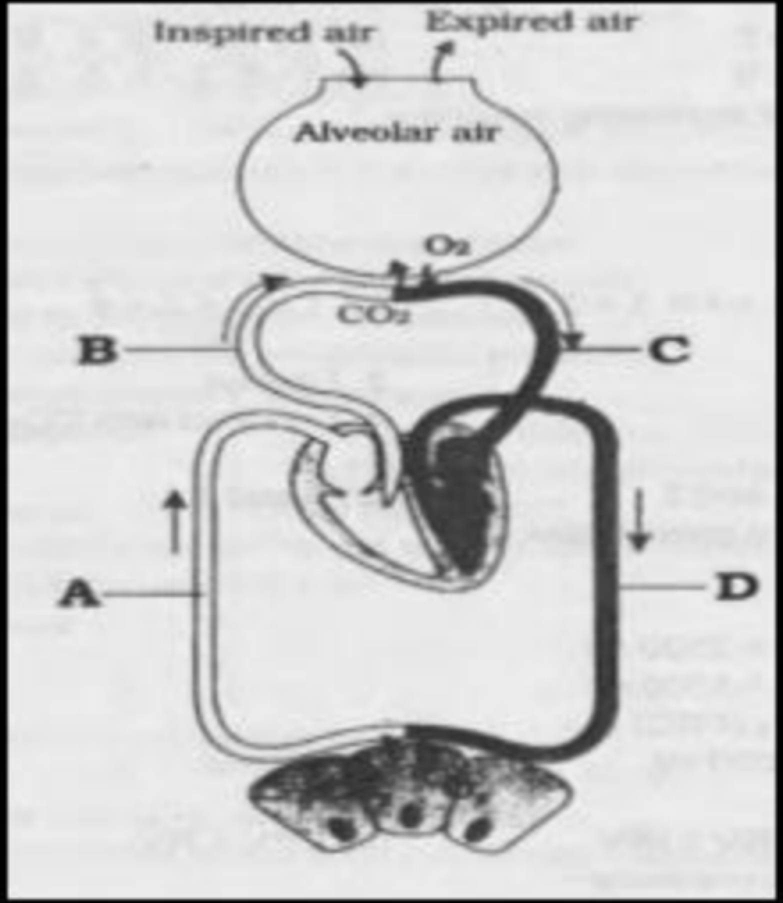
1. O_2 binds with hemoglobin of RBCs to form
(1) Carboxyhemoglobin
(2) Carbaminohemoglobin
(3) Oxyhemoglobin
(4) Aminohemoglobin

2. Partial pressures (in mmHg) of O_2 in atmospheric air, alveoli deoxygenated blood, oxygenated blood and tissues are-
(A) 40, 95, 40, 104, 159
(B) 104, 40, 40, 95, 159
(C) 153, 104, 40, 95, 40
(D) 195, 104, 95, 40, 40

3. Partial pressure (in mm Hg) of CO_2 in atmospheric air, alveoli, deoxygenated blood, oxygenated blood and tissues are-
(A) 0.3, 40, 45, 40, 45
(B) 40, 45, 40, 45, 0.3
(C) 40, 40, 45, 45, 0.3
(D) 0.3, 45, 45, 40, 40

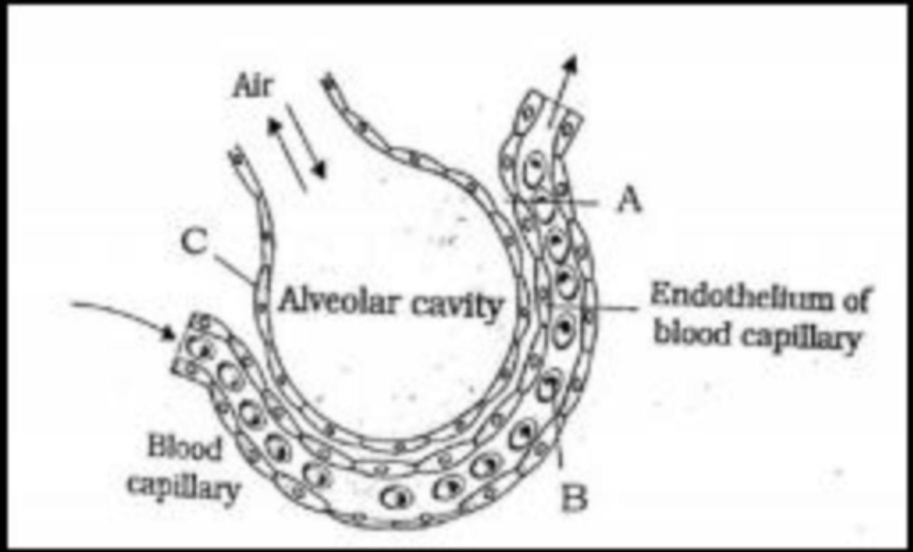
4. Name the blood vessels A to D-

	A	B	C	D
A	Systemic vein	Pulmonary artery	Pulmonary vein	Systemic artery
B	Systemic artery	Pulmonary artery	Pulmonary vein	Systemic vein
C	Pulmonary artery	Systemic vein	Pulmonary vein	Systemic artery
D	Systemic vein	Pulmonary vein	Pulmonary artery	Systemic artery



5. Study the given figure and identify A to C.

	A	B	C
(A)	Basement membrane	RBC	Alveolar wall
(B)	O_2	CO_2	Alveolar O_2
(C)	Pleura	RBC	Pericardium
(D)	Pleura	WBC	Pulmonary vein



6. Percentage of CO_2 transported through the plasma is

(1) About 7% (2) About 3%

(3) About 20–25% (4) About 77%

7. Which factors affect the dissociation of O_2 from Hb?

(1) pH, pO_2, pCO_2 and temperature

(2) Only pH

(3) Salinity, temperature and pCO_2

(4) ions concentration, pH and salinity

8. High percentage of CO_2 is transported in dissolved form as compared to O_2. This is because

(1) O_2 has high solubility in plasma

(2) CO_2 has high solubility in plasma

(3) pCO_2 is high in blood than pO_2

(4) CO_2 has low solubility in plasma

9. The amount of oxygen transported by one litre of blood under strenous condition is approximately

(1) 5 ml (2) 50 ml
(3) 15 ml (4) 150 ml

10. The partial pressure of oxygen in the alveoli of the lungs is

(1) Equal to that in the blood
(2) More than that in the blood
(3) Less than that in the blood
(4) Less than that of carbon dioxide

Think Positively and
Positive Things Will Happen

THANK YOU

MANTHAN NEET 2025

Breathing and Exchange of Gases

LECTURE -5

ZOOLOGY

MD SIR



TODAY'S GOAL

- Transport of Gases - CO_2 ✓✓
- Regulation of Breathing and Disorders

1. O2 binds with hemoglobin of RBCs to form

(1) Carboxyhemoglobin

(2) Carbaminohemoglobin

(3) Oxyhemoglobin

(4) Aminohemoglobin

2. Partial pressures (in mmHg) of O2 in atmospheric air, alveoli deoxygenated blood, oxygenated blood and tissues are-

(A) 40, 95, 40, 104, 159

(B) 104, 40, 40, 95, 159

(C) 159, 104, 40, 95, 40

(D) 195, 104, 95, 40, 40

3. Partial pressure (in mm Hg) of CO2 in atmospheric air, alveoli, deoxygenated blood, oxygenated blood and tissues are-

(A) 0.3, 40, 45, 40, 45

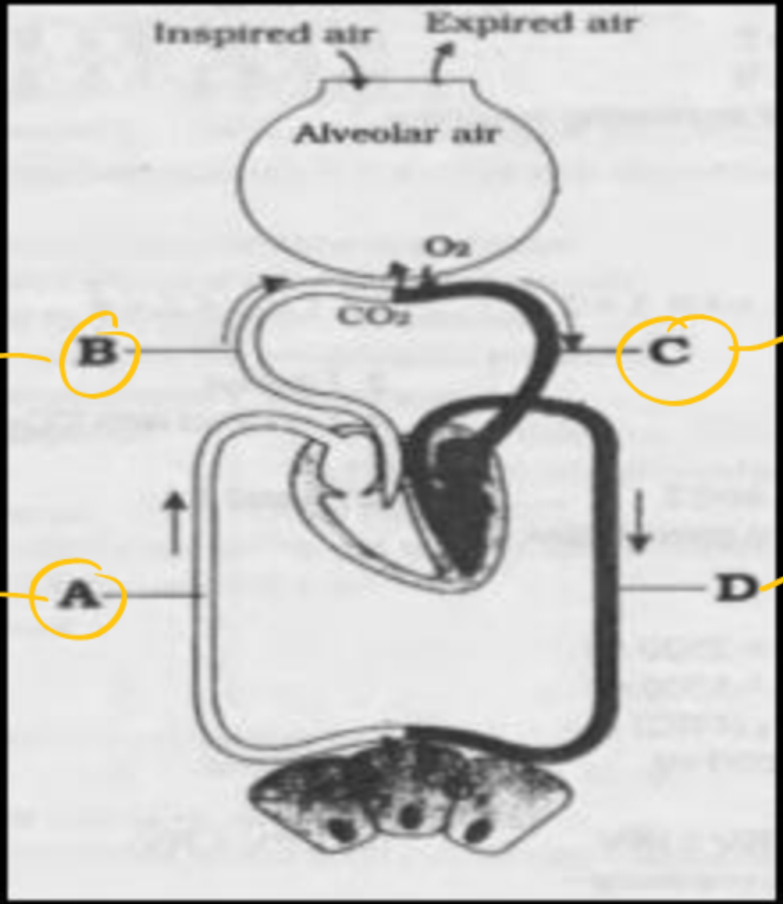
(B) 40, 45, 40, 45, 0.3

(C) 40, 40, 45, 45, 0.3

(D) 0.3, 45, 45, 40, 40

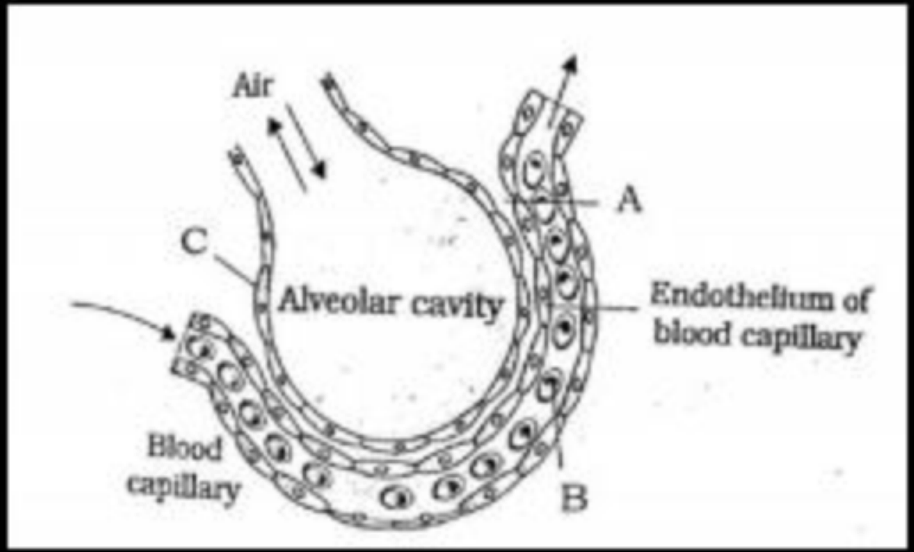
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	A	B	C	D
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B	Systemic artery	Pulmonary artery	Pulmonary vein	Systemic vein
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D	Systemic vein	Pulmonary vein	Pulmonary artery	Systemic artery



5. Study the given figure and identify A to C.

	A	B	C
(A)	Basement membrane	RBC	Alveolar wall
(B)	O_2	CO_2	Alveolar O_2
(C)	Pleura	RBC	Pericardium
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6. Percentage of CO_2 transported through the plasma is

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7. Which factors affect the dissociation of O_2 from Hb?

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(2) Only pH

(3) Salinity, temperature and pCO_2

(4) ions concentration, pH and salinity

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(3) pCO_2 is high in blood than pO_2

(4) CO_2 has low solubility in plasma

9. The amount of oxygen transported by one litre of blood under strenous condition is approximately

(1) 5 ml (2) 50 ml

(3) 15 ml (4) 150 ml

10. The partial pressure of oxygen in the alveoli of the lungs is

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(2) More than that in the blood

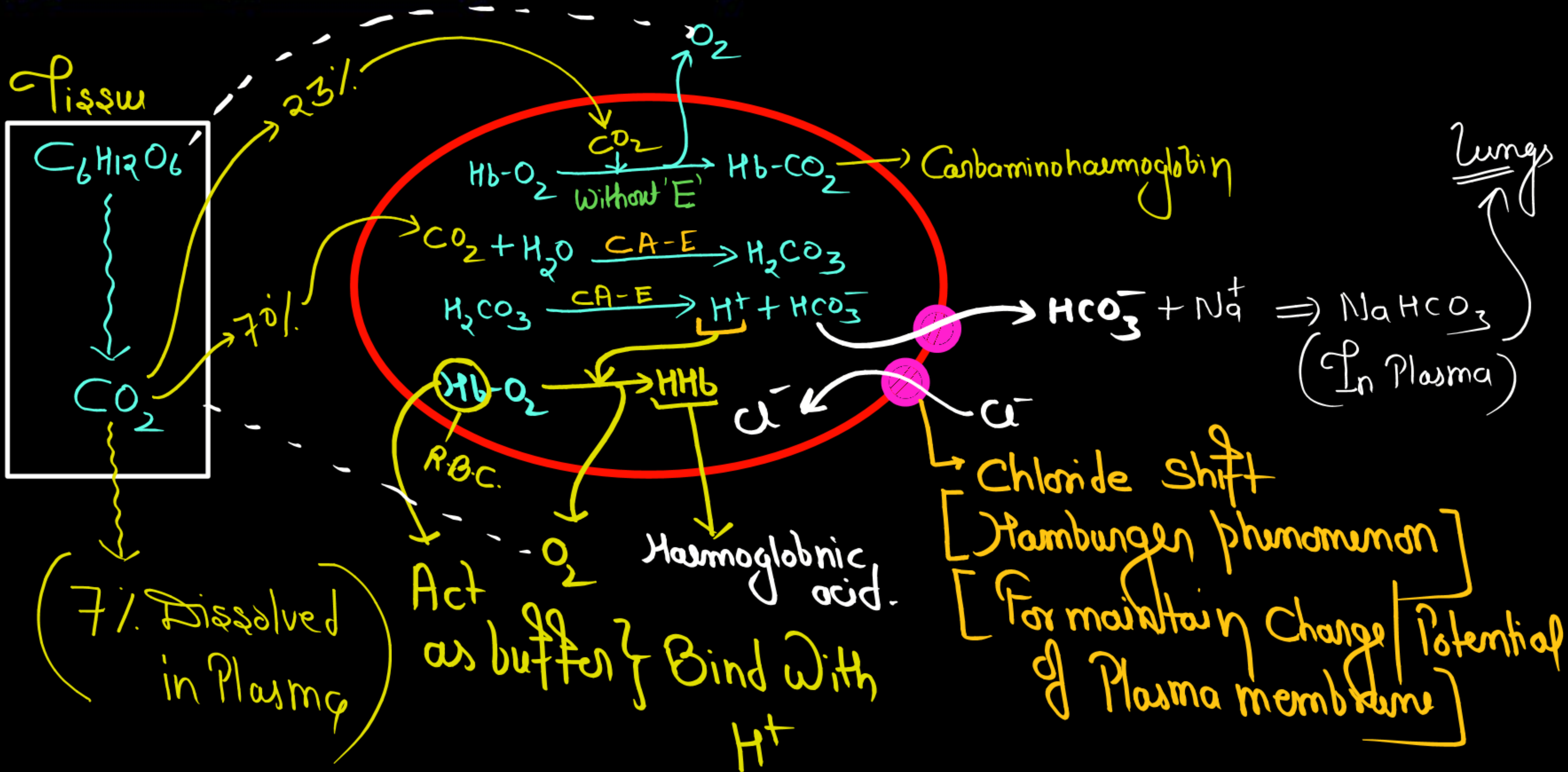
(3) Less than that in the blood

(4) Less than that of carbon dioxide

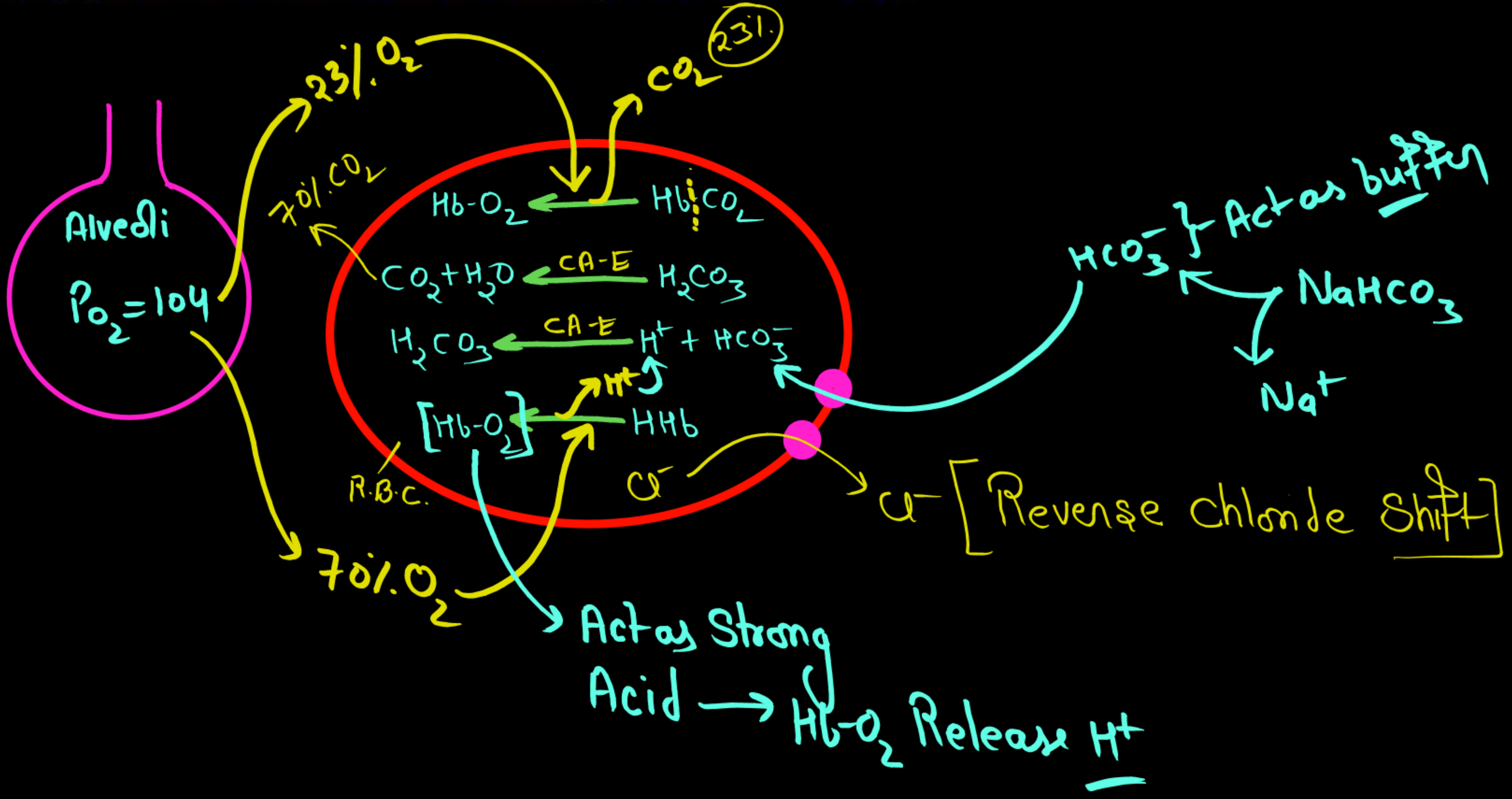
Transport of CO_2

- 7% = Dissolved in plasma (CO_2)
- 70% = Bicarbonate ions (HCO_3^-) = Plasma.
- 23% = Carbaminohaemoglobin ($Hb-CO_2$)

(1) Loading of CO2 (Near Tissue)



(2) Unloading of CO2 (Near Alveoli)



1) [Carbonic anhydrase - Enzyme] ⟶ +nt in
- R.B.C
- Some amount in Plasma

* A = Near = Tissue; Hb-O_2 = Disso. } Bohr's Eff (Curve = R-Shift)

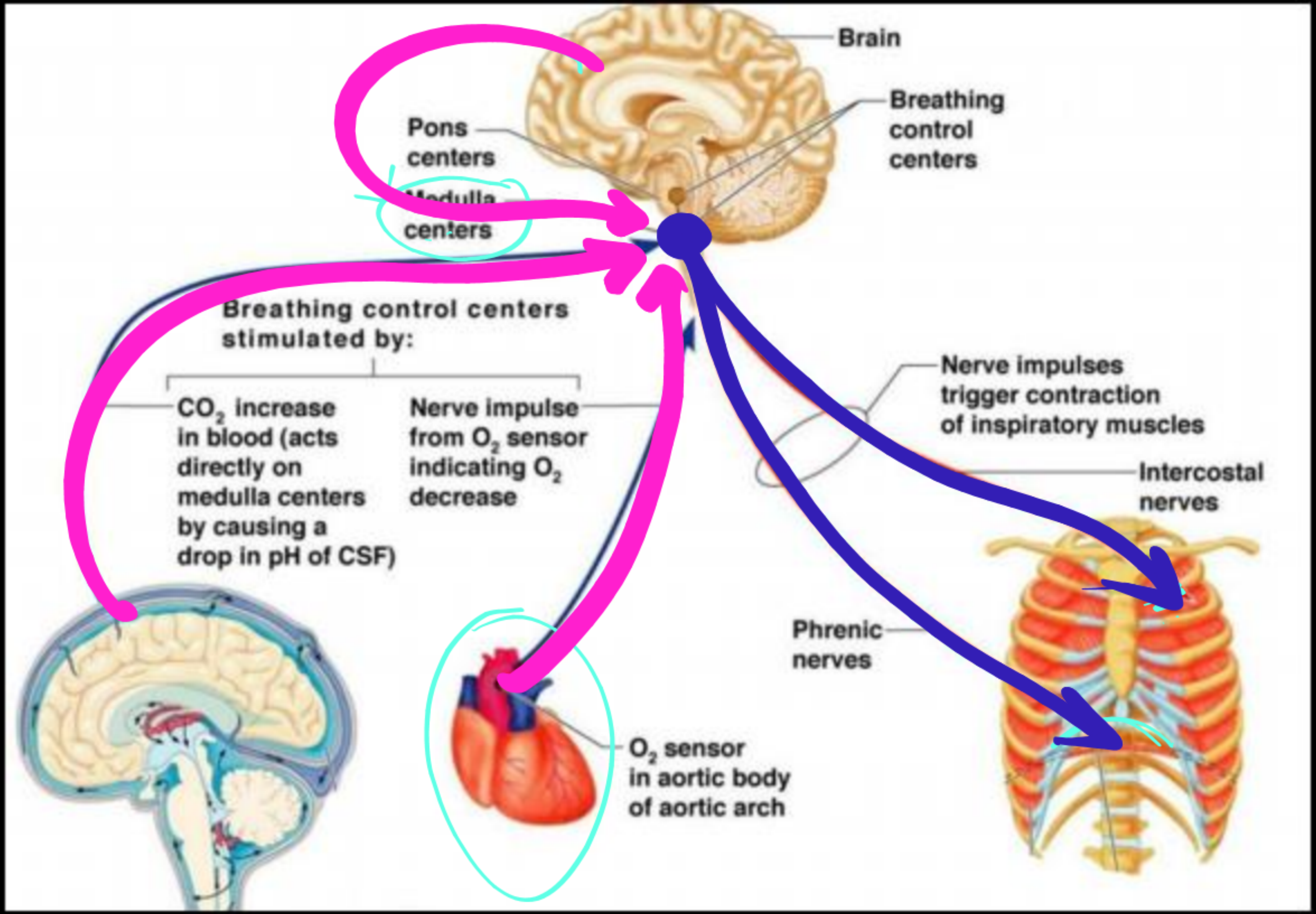
⟶

2) - $CO_2 + H_2O \underset{CA}{\overset{CA}{\rightleftharpoons}} H_2CO_3 \underset{CA}{\overset{CA}{\rightleftharpoons}} H^+ + HCO_3^-$

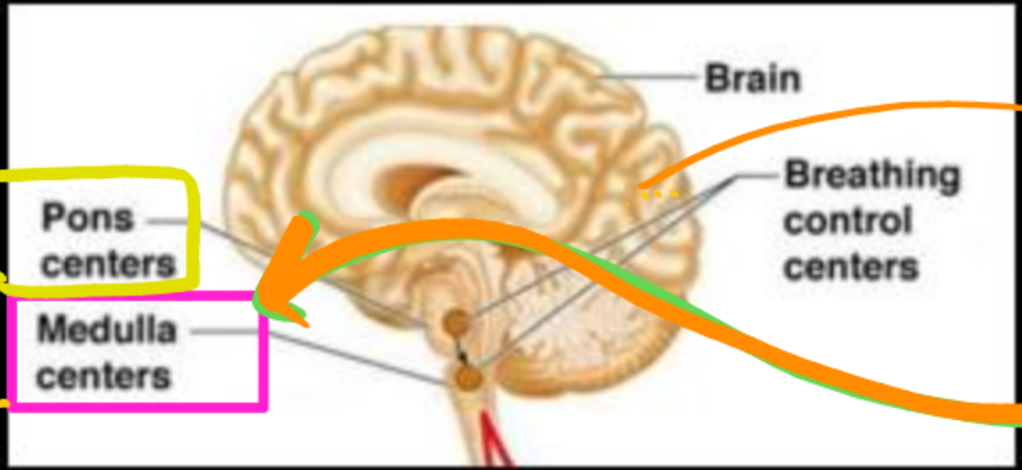
⟵

* B = Near lungs; Hb-O_2 - Association } Haldane Effect (L-Shift)

Regulation of Breathing



Nervous Regulation of Breathing



Cerebrum → Voluntary Breathing

(M.O.) ← [Involuntary Breathing]

DRG = Dorsal Respiratory Group } Normal Breathing

[Inspiratory - Area]
→ Respiratory Rhythm Center
→ Control only - Inspiration
by - Contration of
- E.I.C.M.
- Diaphragm Mus.

VRG = Ventral Respiratory Group } Forceful Brea

[Expiratory Area]
→ Control Contraction of
- I.I.C.M
- Abdominal Muscle

Regulation by Pons →

└→ Switch off - Center (Pneumotaxic Center)

— Stop Inspiration only for ≈ 5 Sec

if Pons Hyperactive ⇒ Stimulate

[M.O.] = ↑ Rate of Breathing

[↓ - Duration of Inspiration]

Chemical Regulation of Breathing

- [Based on Chemo-receptors, Sensitive for < H^+, CO_2]

[Central chemoreceptor]

[+nt near the brain or]

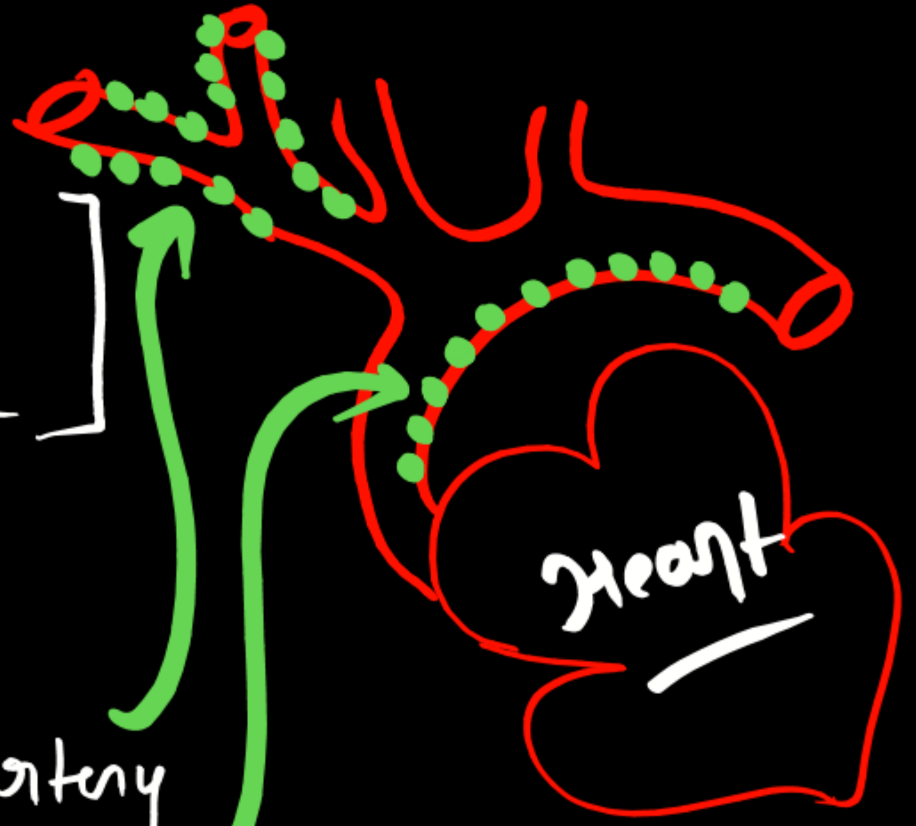
if H^+ & CO_2 ↑ in C.S.F.

[Peripheral-chemo.]

+nt in < Carotid artery, Aorta.

if H^+ & CO_2 ↑ in Blood

[M.O] → ↑ Rate of Breathing



DISORDERS OF RESPIRATORY SYSTEM

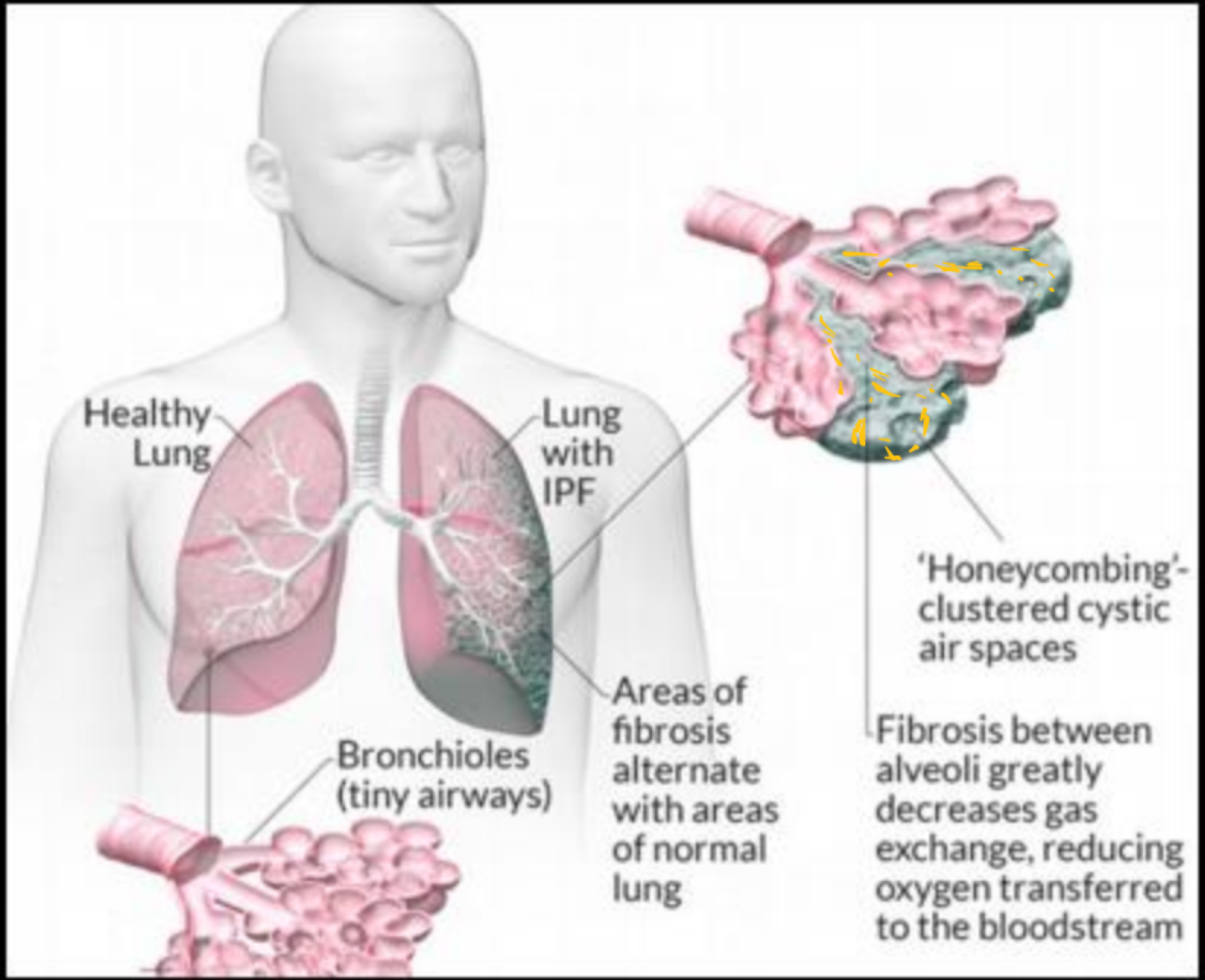
(1) **Asthma** is a difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles.

(2) **Emphysema** is a **chronic disorder** in which alveolar walls are damaged due to which **respiratory surface is decreased**. One of the major causes of this is **cigarette smoking.**



(3) Occupational Respiratory Disorders:

In certain industries, especially those involving grinding or stone-breaking, so much dust is produced that the defense mechanism of the body cannot fully cope with the situation. Long exposure can give rise to **inflammation leading to fibrosis (proliferation of fibrous tissues) and thus causing serious lung damage.** Workers in such industries should wear protective masks.



Pneumoconiosis - Pneumoconiosis is a term that can refer to any chronic lung condition caused by the inhalation of dust or toxic fibers.

Coal worker Pneumoconiosis – Caused by inhalation of coal dust.

Silicosis - Caused by the inhalation of silica dust

Asbestosis - Caused by the inhalation of asbestos.

Byssinosis - Caused by the inhalation of cotton fibers.

17.4.2 Transport of Carbon dioxide

CO_2 is carried by haemoglobin as **carbamino-haemoglobin** (about 20-25 per cent). This binding is related to the partial pressure of CO_2. pO_2 is a major factor which could affect this binding. When pCO_2 is high and pO_2 is low as in the tissues, more binding of carbon dioxide occurs whereas, when the pCO_2 is low and pO_2 is high as in the alveoli, dissociation

of CO_2 from carbamino-haemoglobin takes place, i.e., CO_2 which is bound to haemoglobin from the tissues is delivered at the alveoli. RBCs contain a very high concentration of the enzyme, carbonic anhydrase and minute quantities of the same is present in the plasma too. This enzyme facilitates the following reaction in both directions.

$$CO_2 + H_2O \underset{}{\overset{\text{Carbonic anhydrase}}{\rightleftharpoons}} H_2CO_3 \underset{}{\overset{\text{Carbonic anhydrase}}{\rightleftharpoons}} HCO_3^- + H^+$$

At the tissue site where partial pressure of CO_2 is high due to catabolism, CO_2 diffuses into blood (RBCs and plasma) and forms HCO_3^- and H^+. At the alveolar site where pCO_2 is low, the reaction proceeds in the opposite direction leading to the formation of CO_2 and H_2O. Thus, CO_2 trapped as bicarbonate at the tissue level and transported to the alveoli is released out as CO_2 (Figure 17.4). Every 100 ml of deoxygenated blood delivers approximately 4 ml of CO_2 to the alveoli.

17.5 Regulation of Respiration

Human beings have a significant ability to maintain and moderate the respiratory rhythm to suit the demands of the body tissues. This is done by the neural system. A specialised centre present in the medulla region of the brain called respiratory rhythm centre is primarily responsible for this regulation. Another centre present in the pons region of the brain called pneumotaxic centre can moderate the functions of the respiratory rhythm centre. Neural signal from this centre can reduce the duration of inspiration and thereby alter the respiratory rate. A chemosensitive area

inspiration and thereby alter the respiratory rate. A chemosensitive area is situated adjacent to the rhythm centre which is highly sensitive to CO_2 and hydrogen ions. Increase in these substances can activate this centre, which in turn can signal the rhythm centre to make necessary adjustments in the respiratory process by which these substances can be eliminated. Receptors associated with aortic arch and carotid artery also can recognise changes in CO_2 and H^+ concentration and send necessary signals to the rhythm centre for remedial actions. The role of oxygen in the regulation of respiratory rhythm is quite insignificant.

vImp

17.6 Disorders of Respiratory System

Asthma is a difficulty in breathing causing wheezing due to inflammation of bronchi and bronchioles.

Emphysema is a chronic disorder in which alveolar walls are damaged due to which respiratory surface is decreased. One of the major causes of this is cigarette smoking.

Occupational Respiratory Disorders: In certain industries, especially those involving grinding or stone-breaking, so much dust is produced that the defense mechanism of the body cannot fully cope with the situation. Long exposure can give rise to inflammation leading to fibrosis (proliferation of fibrous tissues) and thus causing serious lung damage. Workers in such industries should wear protective masks.

H.W.

1. What is Bohr's effect?
(A) Raise of pCO_2 or fall in pH decreases the oxygen affinity of haemoglobin
(B) Decrease of pCO_2 or fall in pH decreases the oxygen affinity of haemoglobin
(C) Raise of pCO_2 or increase in pH decreases the oxygen affinity of haemoglobin
(D) Shifting of the oxygen-haemoglobin curve to left

2. The percentage of oxygen in inhaled air is about
(A) 21% (C) 16%
(B) 79% (D) 4%

3. What happens in Hamburger shift?
(A) HCO_3^- ions move out from plasma and Cl^- ions enters into RBC
(B) CO_3^- ions move out from plasma and Cl^- ions enters into RBC
(C) H^+ ions move out from plasma and Cl^- ions enters into RBC
(D) HCO_3^- ions move out from plasma and H^+ ions enters into RBC

4. Every 100 mL of deoxygenated blood delivers approximately?

(A) 3 mL of CO_2 (B) 2 mL of CO_2

(C) 4 mL of CO_2 (D) 1 mL of CO_2

5. Which of the following conditions are found in the alveoli of lungs?

I. High pO_2 II. Low pCO_2

III. High pCO_2 IV. Low pO_2

V. Low H^+ VI. High H^+

Choose the correct option.

(A) I, III and V (B) III, IV and VI

(C) I, IV and VI (D) I, II and V

6. Left shift of oxyhaemoglobin curve is noticed under

(A) Normal temperature and pH

(B) Low temperature and high pH

(C) Low pH and high temperature

(D) Low pH and low temperature

7. Total percentage of CO_2 transported blood plasma is –

(A) 3% (B) 77%

(C) 23% (D) 7 %

8. Each molecule of haemoglobin when 50% saturated carries how many molecules of O_2 –

(A) 1 (B) 2

(C) 4 (D) 20

9. Binding of O_2 with haemoglobin is primarily related to –

(A) pO_2 (B) pCO_2

(C) H^+ conc. (D) None

10. Oxygen dissociation curve is –

(A) J-shaped

(B) S-shaped

(C) L-shaped

(D) Zig-zag

11. Which of the following is incorrect about the given graph.

(A) Increase in partial pressure of CO2 shift the curve to right.
(B) At low temperature the curve shifts to left.
(C) At high pH the curve shifts to right.
(D) Decrease in partial pressure of oxygen shifts the curve to right.

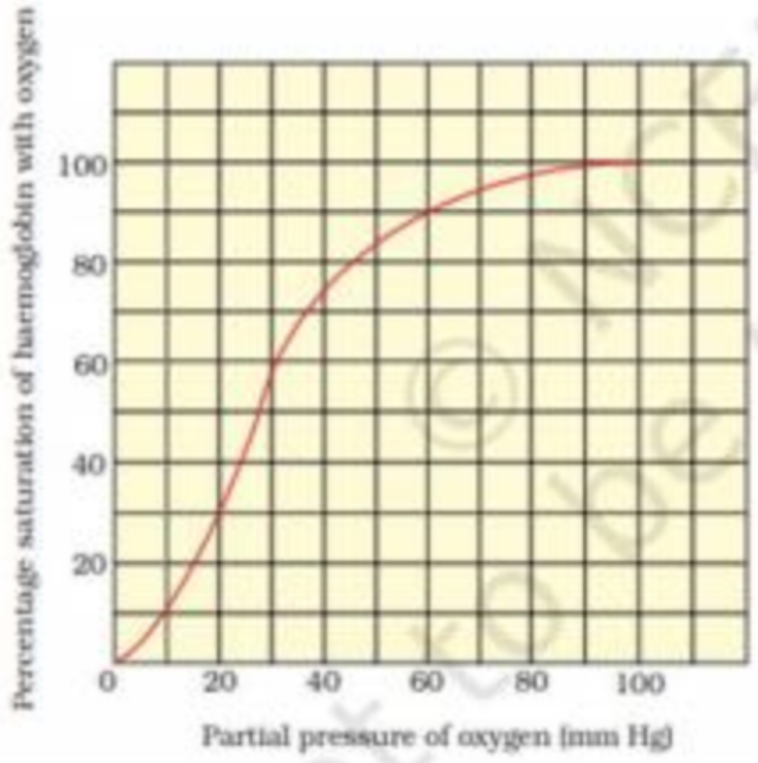


Figure 17.5 Oxygen dissociation curve

12. Respiratory process is regulated by certain specialized centres in the brain. One of the following listed centres can reduce the inspiratory duration upon stimulation –
(A) Medullary inspiratory centre
(B) Pneumotaxic centre
(C) Chemosynthetic centre
(D) Apneustic centre

13. Pneumotaxic centre is present in –
(A) Pons
(B) Medulla oblongata
(C) Cerebrum
(D) Cerebellum

14. The breathing centre initiates ventilation in response to –
(A) A decrease in air pressure
(B)A decrease in O_2
(C) An increase in CO_2
(D) The rate of gas exchange in the alveoli

15. All of the following factors play role in the regulation of respiratory rhythm except –
(A) CO_2 (B) H^+ conc.
(C) O_2 (D) None of the above is correct

16. Asthma is caused by –
(A) Infections of lungs (B) Infection of trachea
(C) Spasm in bronchial muscles (D) Infection in nose

17. One reason for emphysema is –
(A) Cigarette smoking (B) Drug addiction
(C) Wine consumption (D) Heavy exercise

18. Emphysema is characterised by –
(A) Permanent enlargement and destruction of alveolar area leading to reduction in respiratory surface
(B) Inhibition of respiratory centre
(C) Accumulation of fluid in lungs
(D) Spasm of muscles of trachea

19. Why do human beings have difficulty breathing at high elevations?
(A) O_2 makes up lower percentage of air there
(B) The temperature is lower there
(C) The barometric pressure is higher there
(D) pO_2 is lower there

20. Which of the following .diseases are occupational respiratory disorder?
(A) Silicosis, Fibrosis and asbestosis
(B) Emphysema and mountain sickness
(C) Asthma and Emphysema
(D) Asthma and Hepatitis

Think Positively and Positive Things Will Happen

THANK YOU

MANTHAN NEET 2025

Breathing and Exchange of Gases

SUMMARY

ZOOLOGY

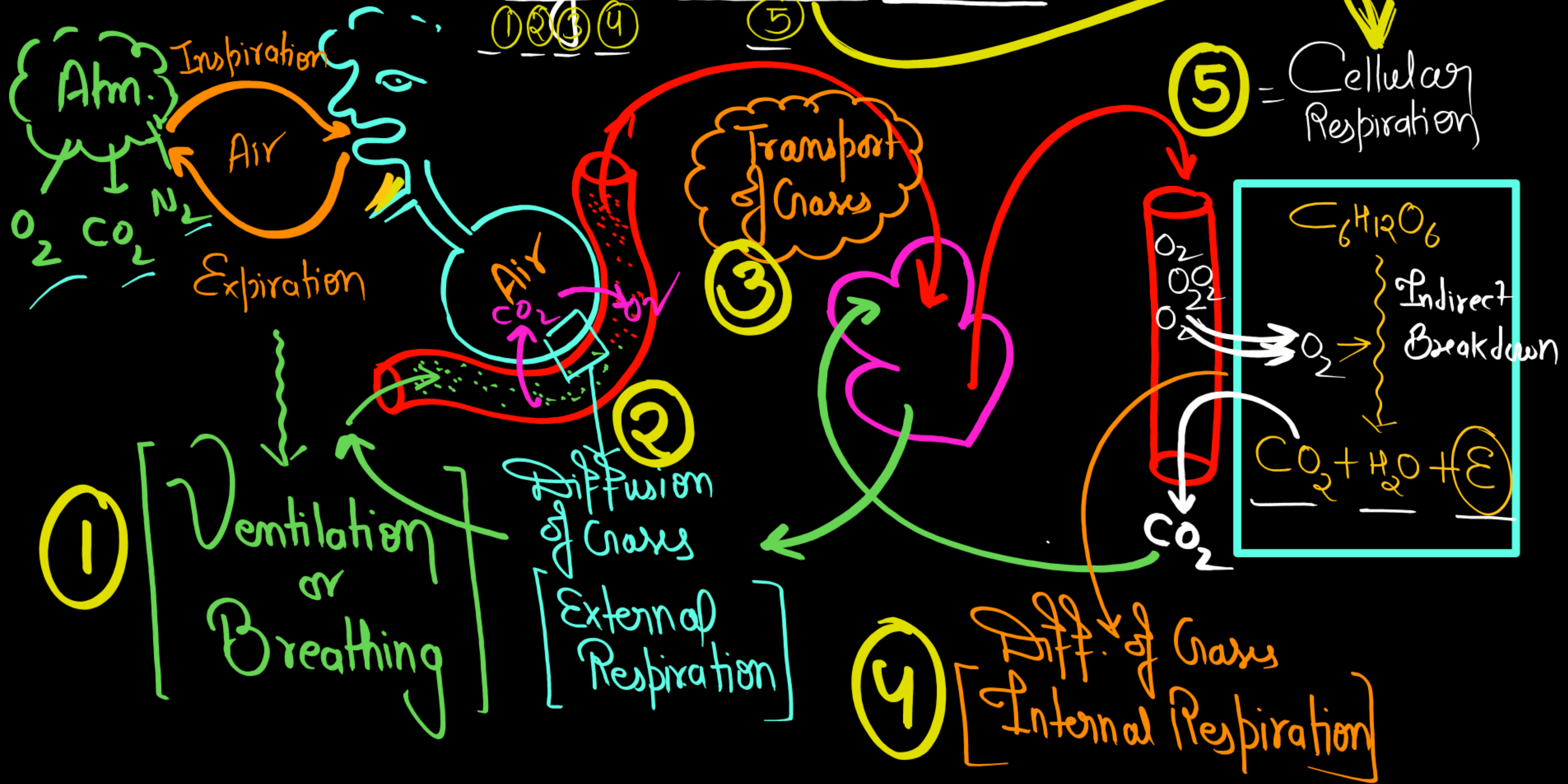
MD SIR



TODAY'S GOAL

SUMMARY ✓

Respiration → Physico-Chemical Process



RESPIRATORY ORGANS

Mechanisms of breathing vary among different groups of animals depending mainly on their habitats and levels of organization.

Imp

Imp

Body Surface → Porifera, Coelenterata, Ctenophora, Platyhelminthes (Planaria or) or Flat worm

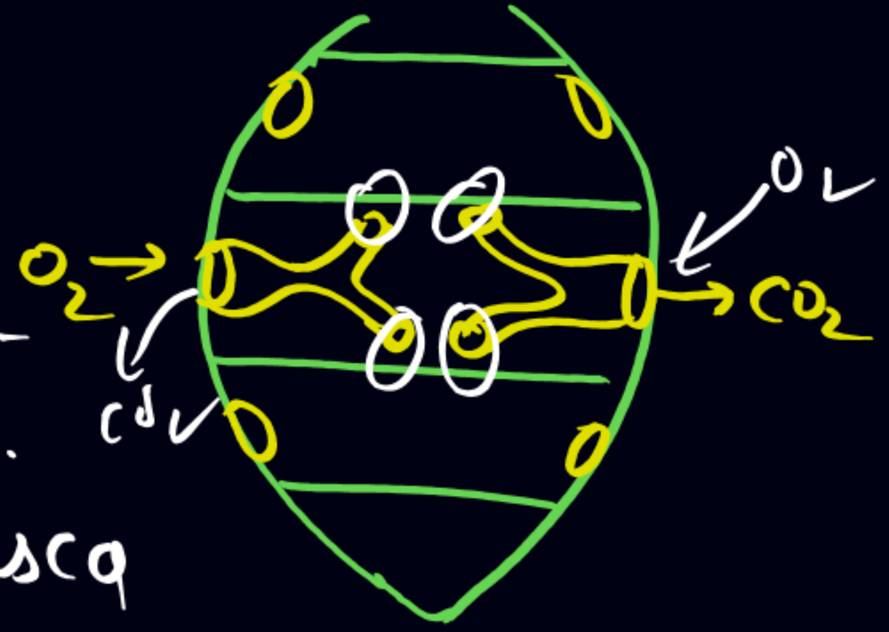
Mosit Cuticle & through Moist Skin } Cutanious Respiration

Earthworm = [Skin + Nonliving Cuticle]

Adult Frog } Moist Skin

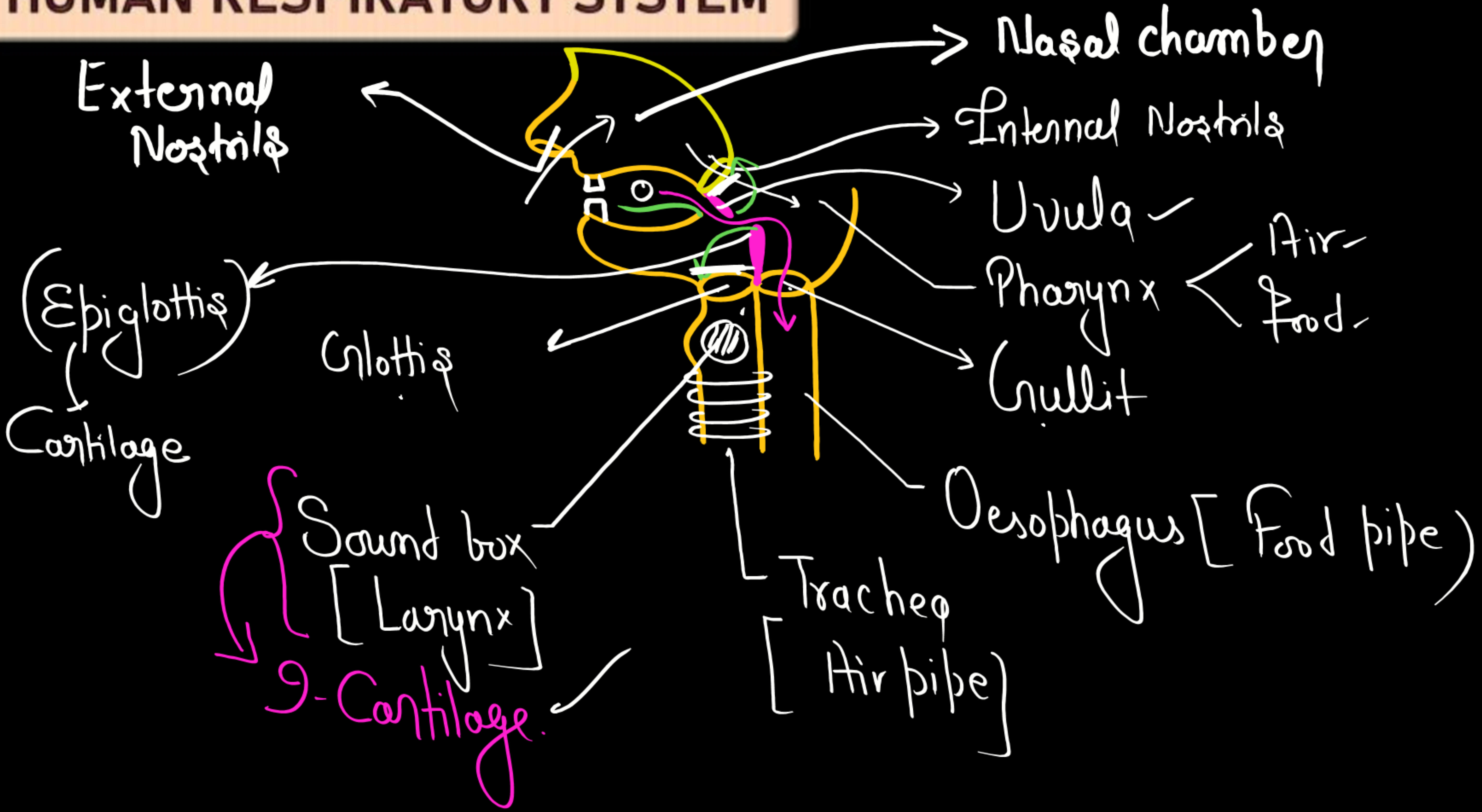
- Network of Tubules → Insecta [Cockroach]
  [Trachial Respiration]

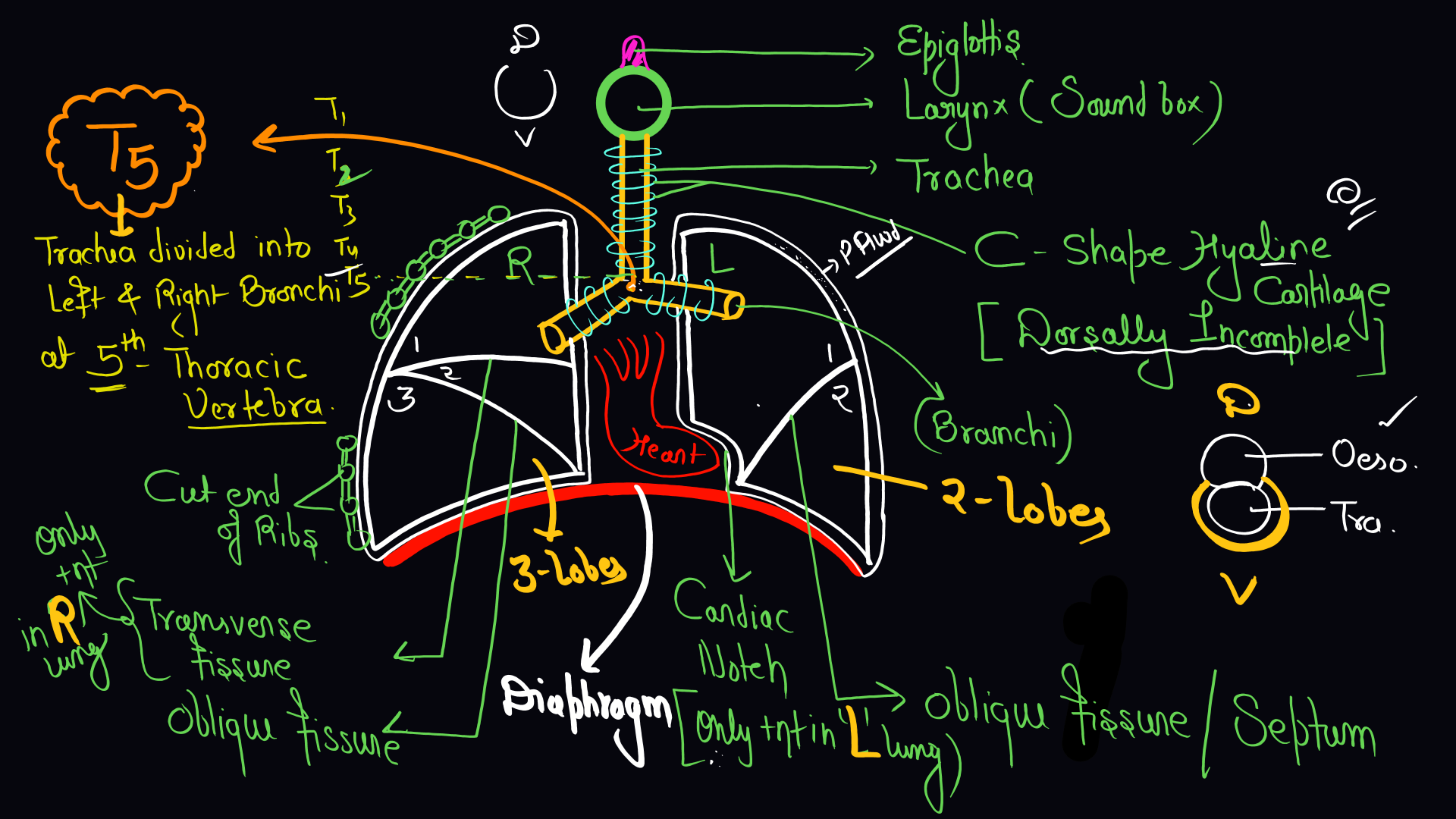
- Gills [Special Vascular Structure] → Fish
  ↳ [Branchial Respiration]
  - Aqua. Arthropoda.
  - Aqua. Mollusca
  - Larva of Frog



- Lungs [Special Vascularised Bags] → eg — Amphibia to Mammalia.
  ↳ [Pulmonary Respiration]
  Pulmonary — lungs.

HUMAN RESPIRATORY SYSTEM




D
V
Epiglottis
Larynx (Sound box)
Trachea
C - Shape Hyaline Cartilage
[Dorsally Incomplete]
T5
Trachea divided into Left & Right Bronchi at 5th - Thoracic Vertebra.
T1
T2
T3
T4
T5
R
L
1
2
3
1
2
Heart
(Bronchi)
2-Lobes
3-Lobes
D
Oeso.
Tra.
V
Cut end of Ribs.
only +nt in R lung
Transverse fissure
Oblique fissure
Diaphragm
Cardiac Notch [Only +nt in 'L' lung]
oblique fissure / Septum

Function of Conducting zone

1. Conduction of air from Ex. Nostrils to Respiratory Zone
2. Clear conducting air from foreign particle
3. Humidification of air
4. Maintain temp. of conducting air according to body temp.

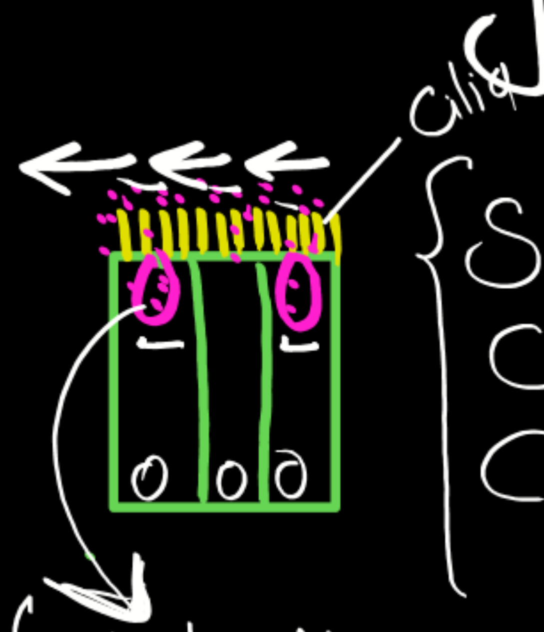
Respiratory Zone

1. Diffusion of gases

Trachea
↓
Pri. Bronchi
↓
Sec. Bronchi
↓
Ter. Bronchi
↓
Initial Bronchiole
↓
Terminal " (-nt in)

↓
Respiratory Bronchiole
↓
Alveolar Sac
↓
Alveoli

Epithelial Tissue in Conducting Zone ⇒



Simple Ciliated Columnar Epi. Tissue.

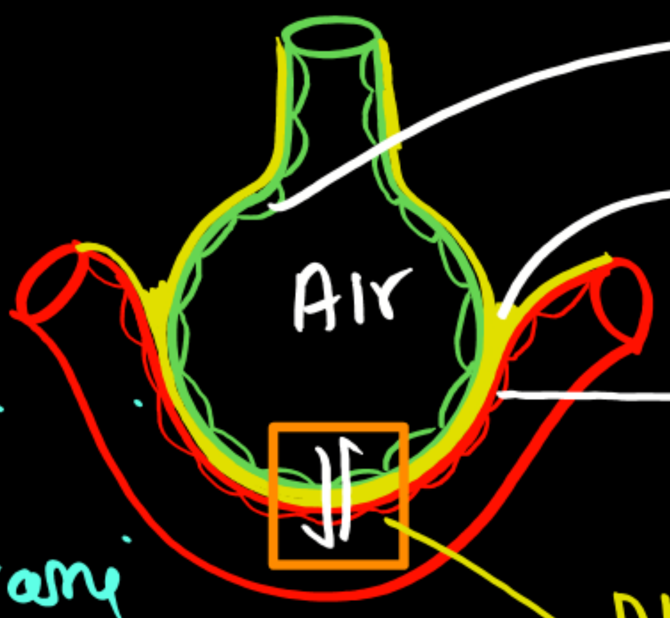
Goblet Cells → Mucus

Epi. Tissue in Respiratory Zone.



Simple Squamous Epi. Tissue

Structure of Alveoli



→ Simple Squ. Epi. of Alveoli ✓

→ Basement Membrane ✓

→ Endothelium of Blood Capillary ✓

* Rate of Diffusion $\propto \frac{1}{\text{Thickness of Membrane}}$

* Rate of Diff. ∝ Solubility of Gases

* Rate of Diff ∝ Partial Pressure of Gases.

vvvImp

No. of Diffusion layer = 3 ✓

- Simple Squ. of Alveoli
- Basement of both
- Endothelim of blood Capillary

(Thickness)

⇓

(< 1 mm)

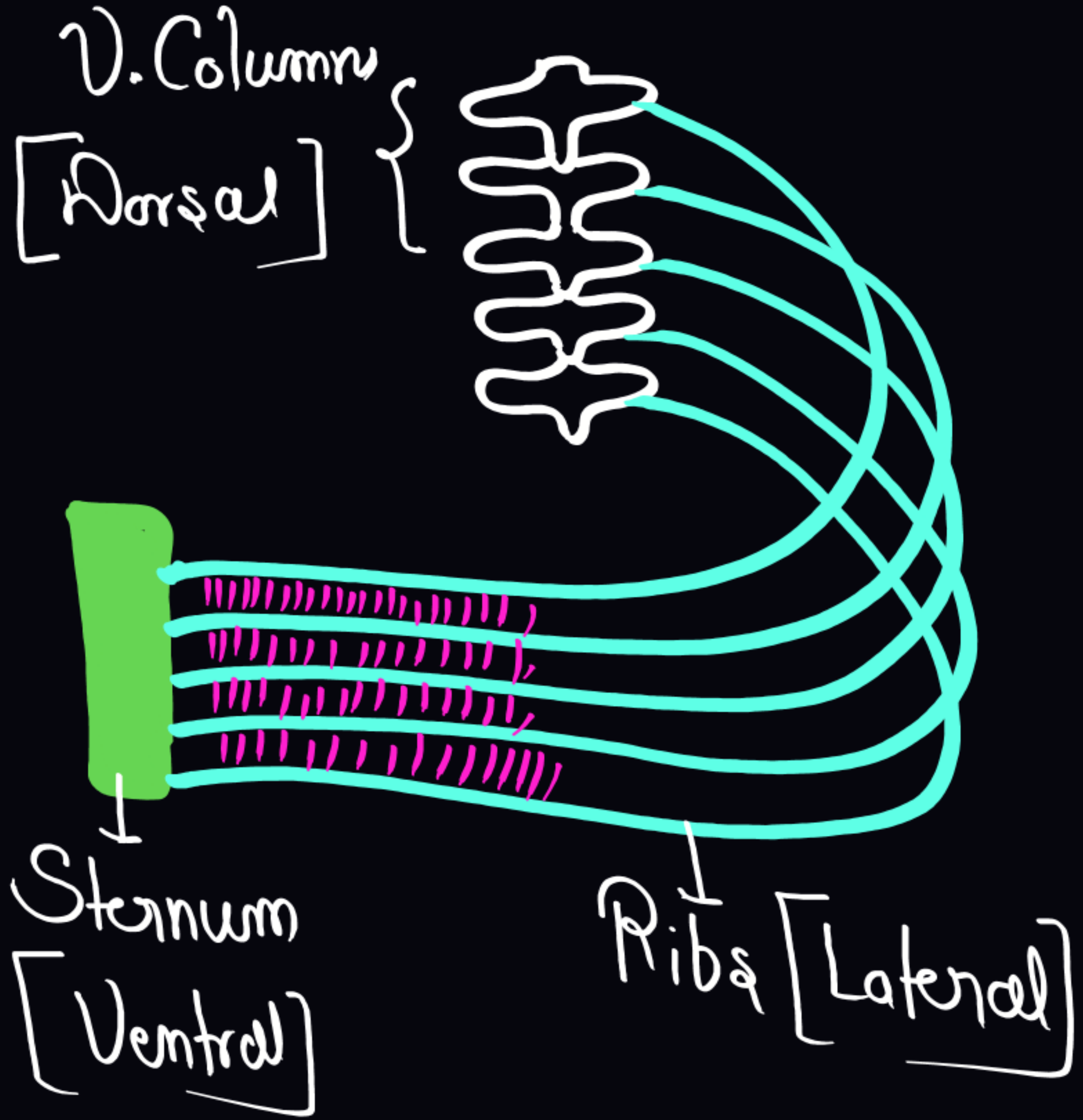
Thoracic Chamber }

Dorsally = V. Column

Ventrally = Sternum

Laterally = Ribs

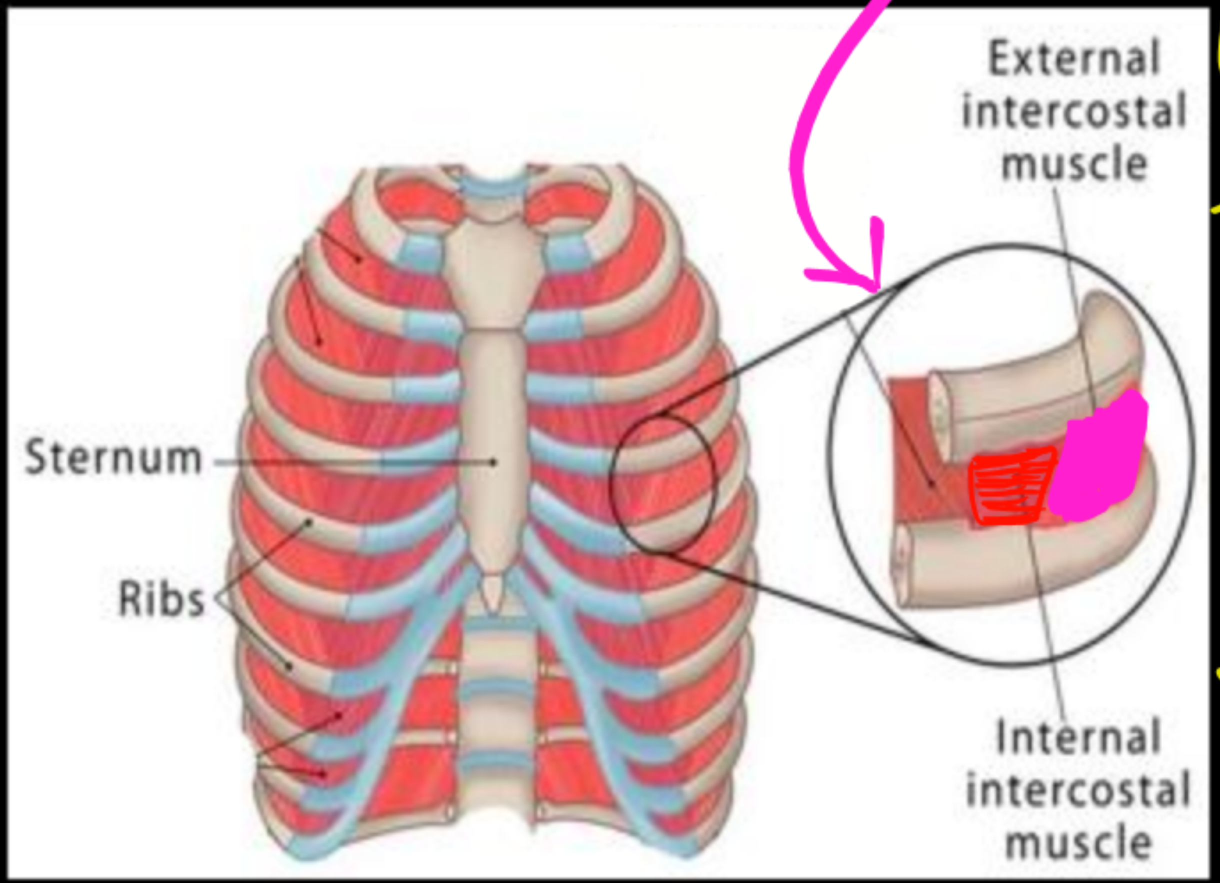
Lower Side = Diaphragm ✓



Mechanism of Breathing

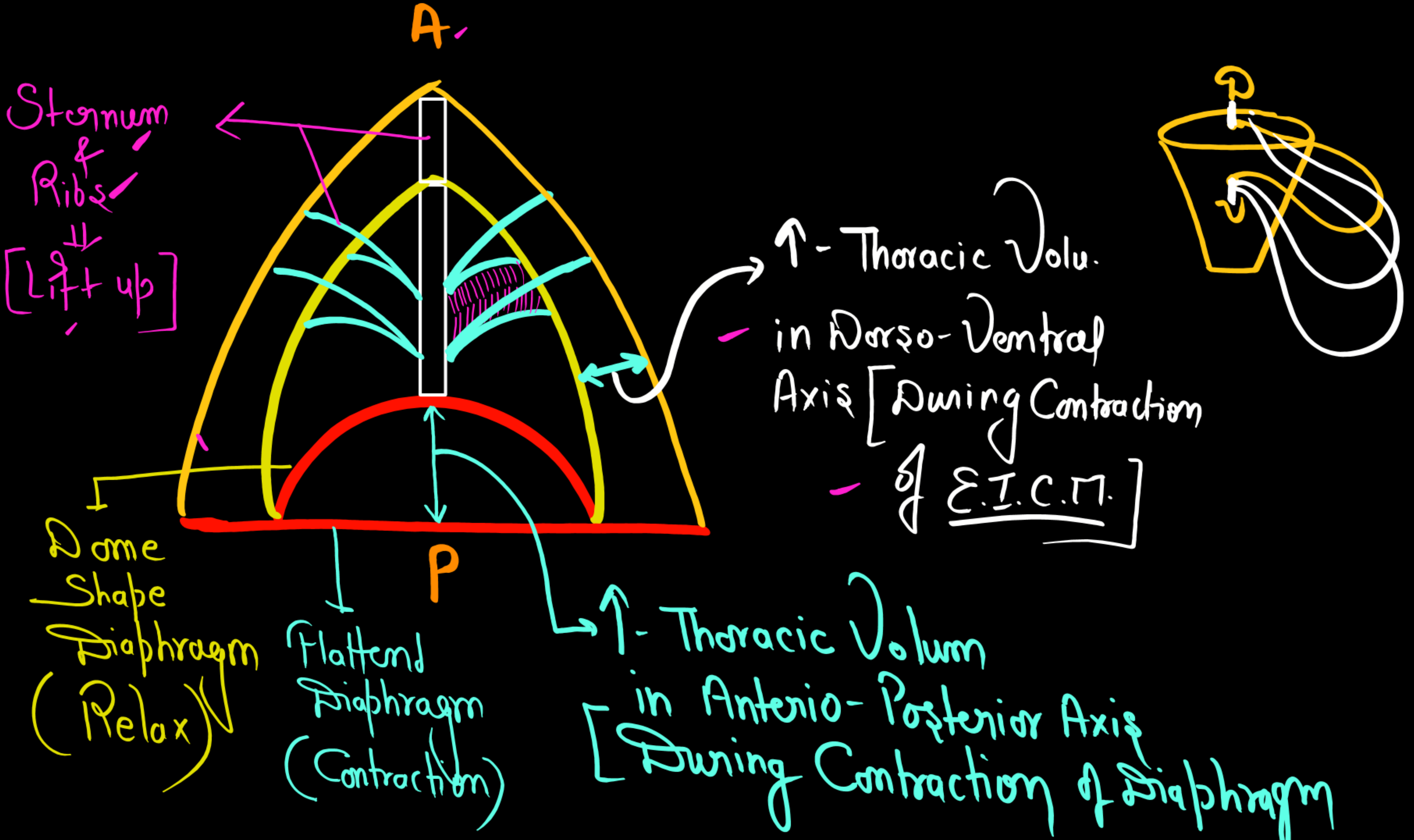
It is alternate contract and relaxation of mainly two types of muscle-

- Diaphragm muscle/Phrenic muscle
- Intercostal muscle



EICM → Normal Breathing
- Contract = ↑ - Thoracic Volu.
- Relax = ↓ - Thoracic Volu.

IICM → Forceful Breathing
- Contract = ↓ - Thoracic Volu.
- Relax = ↑ Thoracic Volu.



A
Sternum & Ribs
⇓
[Lift up]
↑ - Thoracic Volu.
in Dorso-Ventral Axis [During Contraction of E.I.C.M.]
Dome Shape Diaphragm (Relax)
P
Flattend Diaphragm (Contraction)
↑ - Thoracic Volum
in Anterio-Posterior Axis
[During Contraction of Diaphragm

Inspiration (Active)

1) Contraction in Diaphragm Mus.
[↑ - Thoracic Volu. in A-P axis]

↓

2) - Contraction in E.I.C.M
[↑ - Thoracic Volu. in D-V axis]

⇓

↓ Intrapulmonary pressure

⇓

Inspiration

Expiration (Passive)

Relaxation ....]
[↓ - Tho ....]

↓

Relaxation ....]
[↓ Thoracic Volu ......]

⇓

↑ - Intrapulmonary Pressure

⇓

Expiration

Forced Expiration

T.I.C.M + Abdominal Muscles → Contract

⇓

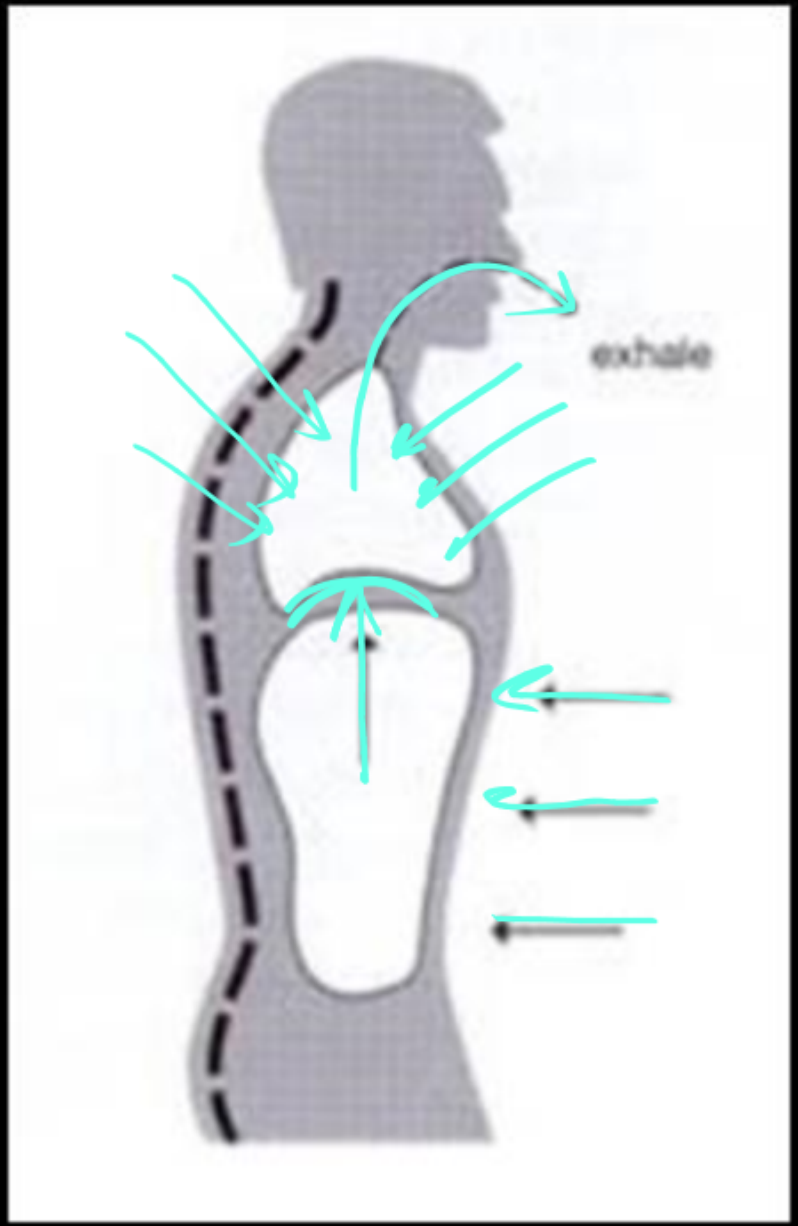
↓↓ Thoracic Volu.

⇓

↑↑ Intrapulmonary Pressure

⇓

(Forced Expiration)

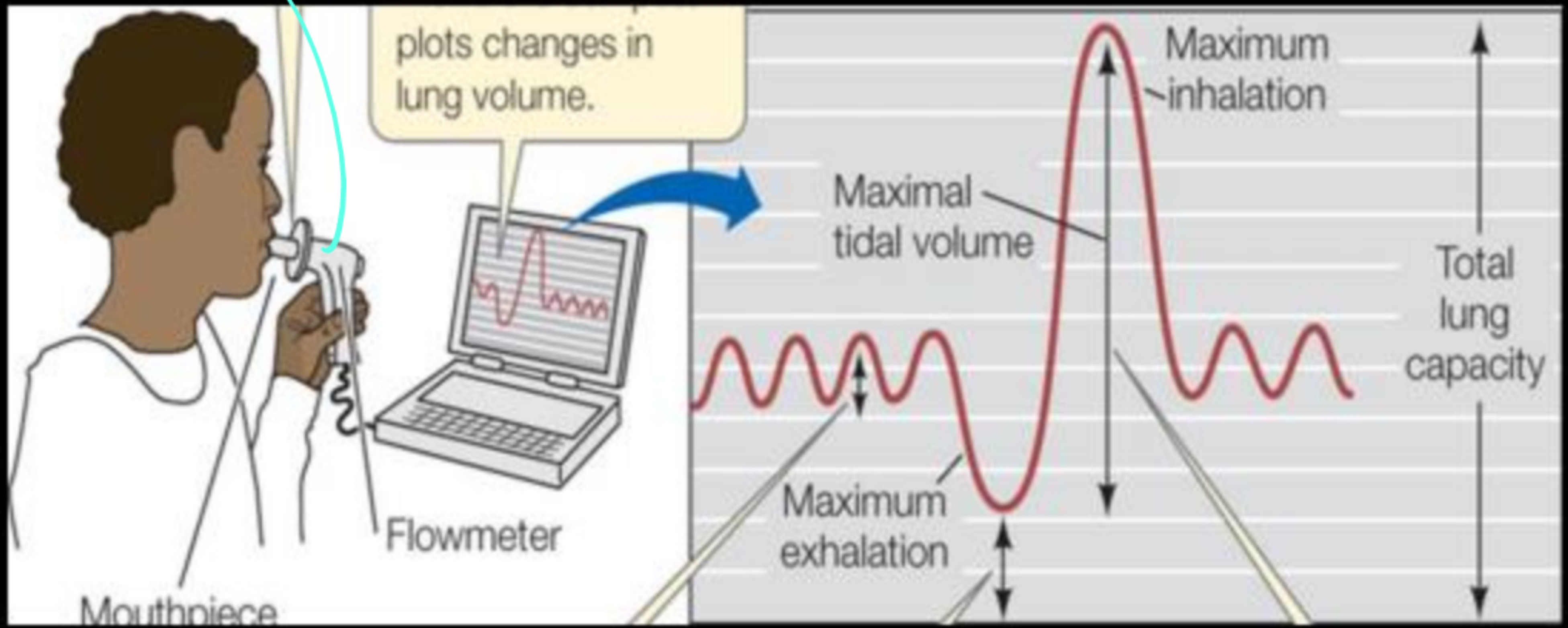


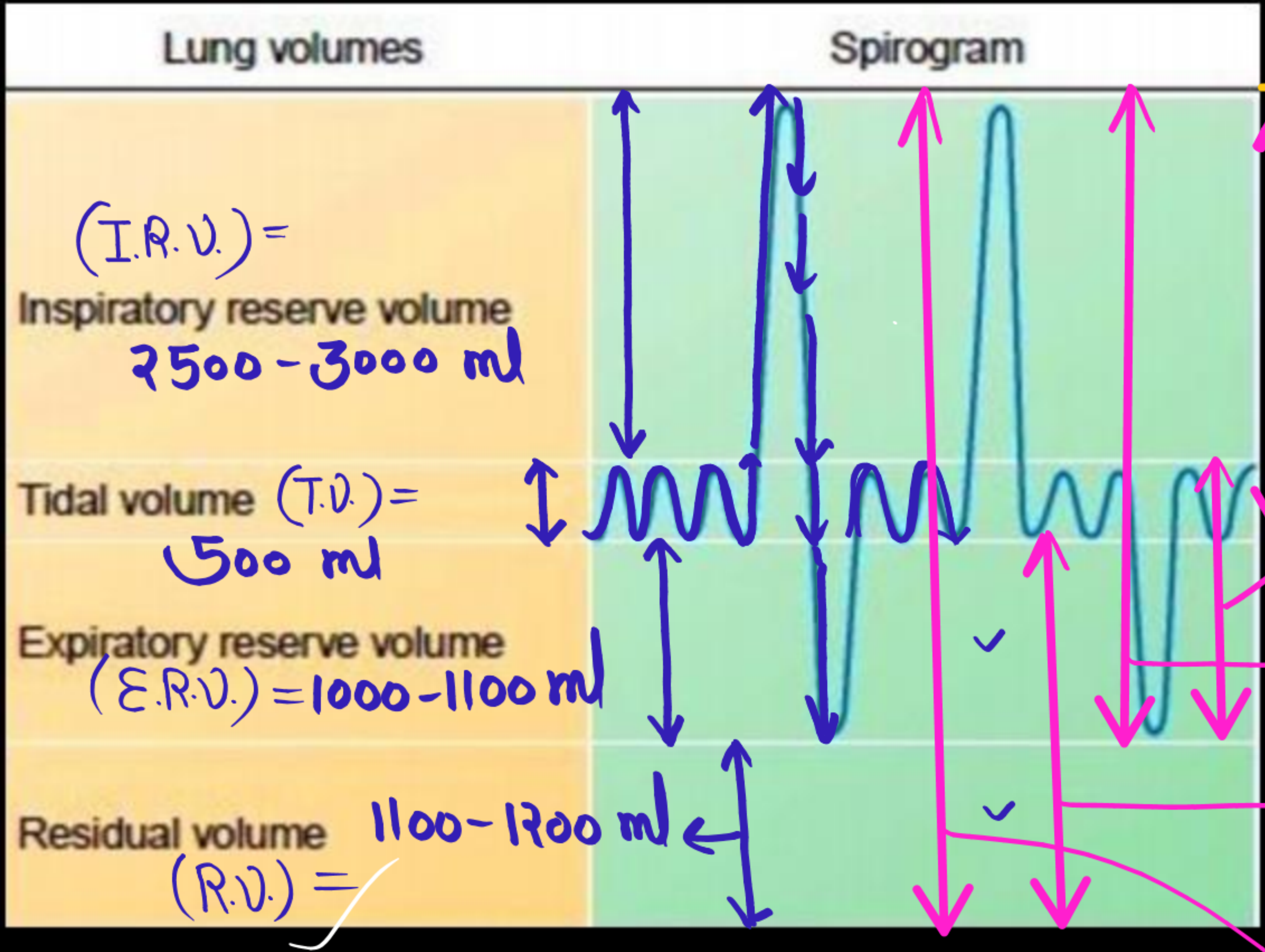
Respiratory Volumes and Capacities

- On an average, a healthy human breathes 12-16 times/minute.

Spirometer

Spirogram





lung Capacities

I.C. = T.V + I.R.V

E.C. = T.V. + E.R.V.

V.C = T.V. + ERV + IRV

F.R.C = E.R.V + RV

T.L.C. = T.V + ERV + IRV + RV or (VC + RV)

Note –

- Spirometry cannot be used to measure the residual volume or any capacities which incorporate the residual volume such as functional residual capacity (FRC) and total lung capacity (TLC).

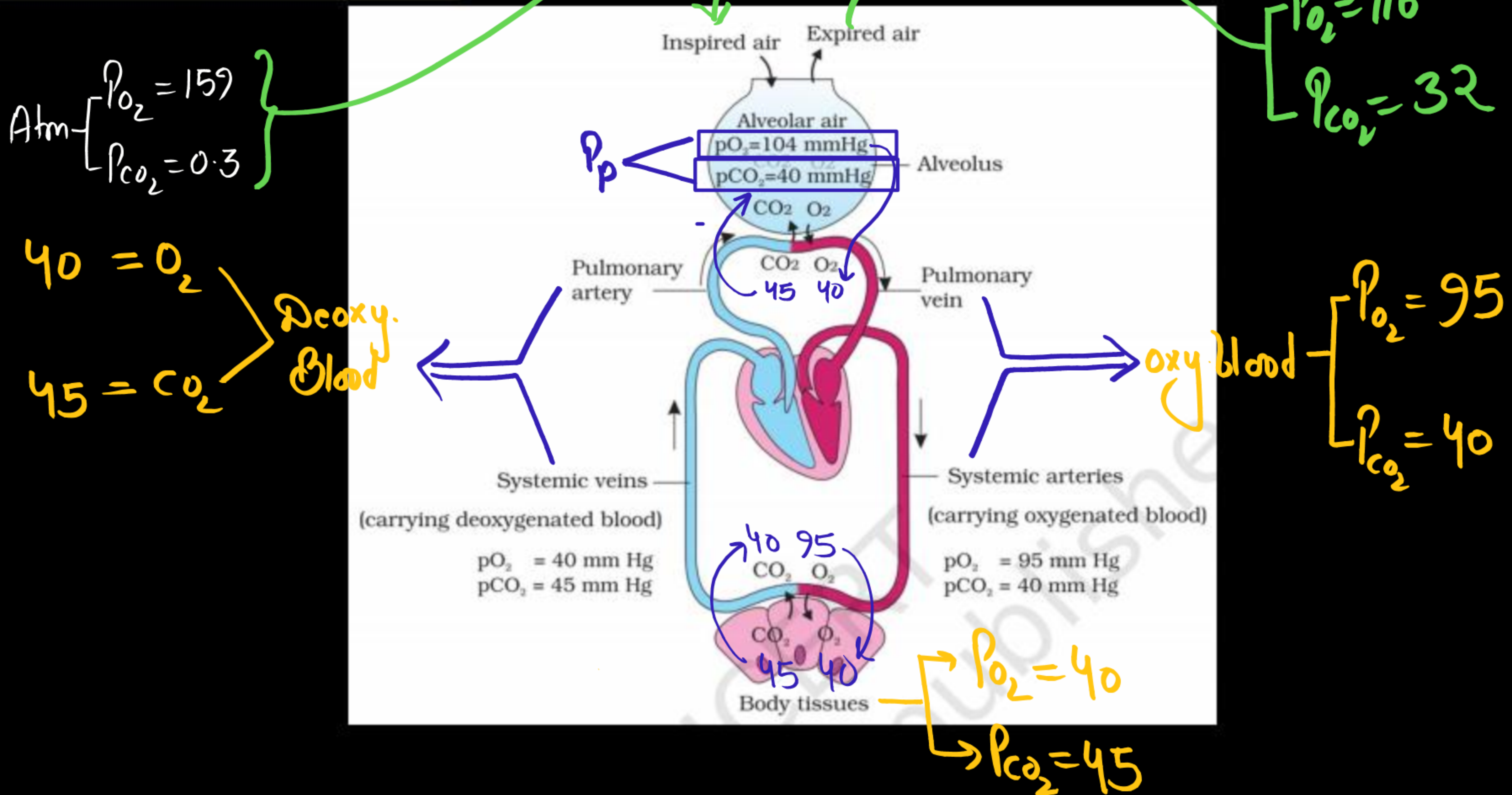
- **Pulmonary Ventilation -** /minute

P.V. = Rate of Breathing X T.V.

= 12-16 X 500

= 6000-8000 ml/minute.

Exchange of Gases



vvImp

pO_2 = Atm. (159) → lung (104) → oxy. blood (95) → Tissue (40) (Utilization of O_2)

pCO_2 = Tissue (45) → Deoxy. blood (45) → lungs (40) → Expired Air (32) → Atm. (0.3)

Table 17.1 Partial Pressures (in mm Hg) of Oxygen and Carbon dioxide at Different Parts Involved in Diffusion in Comparison to those in Atmosphere

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

Transport of Gases

Transport of O_2

1) → 2-3 % = Through Plasma
   [O_2 less Soluble in Plasma]

2) → 97-98% = Through H.b./R.B.C

Transport of CO_2

- → 7% = Dissolved in plasma (CO_2)
- → 70% = Bicarbonate ions (HCO_3^-) } Through Plasma

  } Through Plasma 77%

  (20-25 times more Soluble in Plasma.)

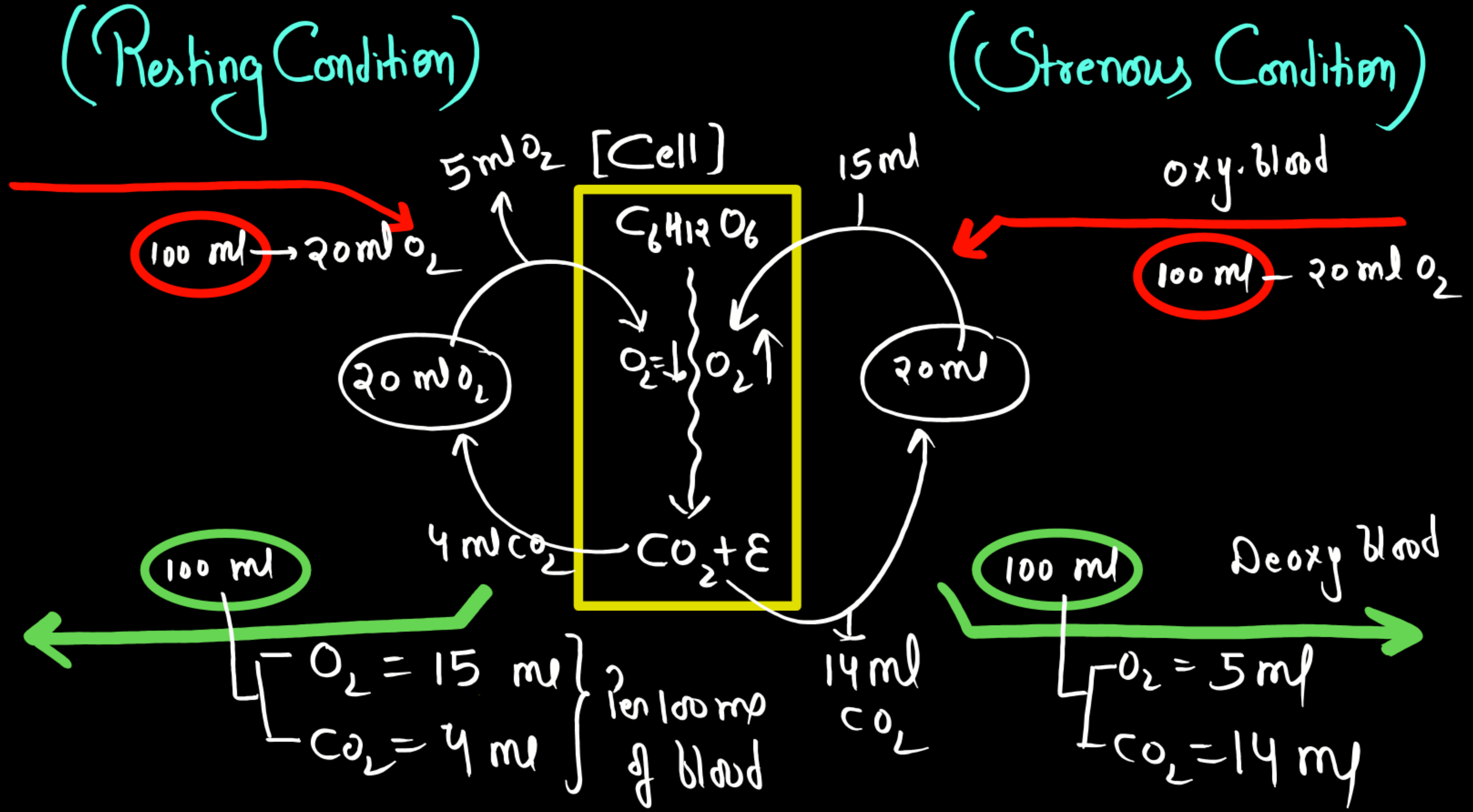
- → 23% = Hb/R.B.C } Carbaminohaemoglobin ($Hb-CO_2$)

Amount of transport of O2 and CO2 during resting and strenuous exercise

In a Healthy Human

- Per 100 ml of blood contain 15 gm Hb
- 1 gm Hb carry 1.34 ml O2
- 15 gm Hb carry 1.34 x 15 ml = 20 ml O2
- Per 100 ml of Oxygenated blood carry 20 ml O2

Resting	Strenuous
Oxy → 20ml/100	Oxy → 20ml/100
5ml O_2 → Tissue	15 ml O_2 → Tissue
4ml CO_2 ←	14 ml CO_2 ←
Deoxy – O_2 = 15, CO_2 = 4	Deoxy – 5ml, 14ml



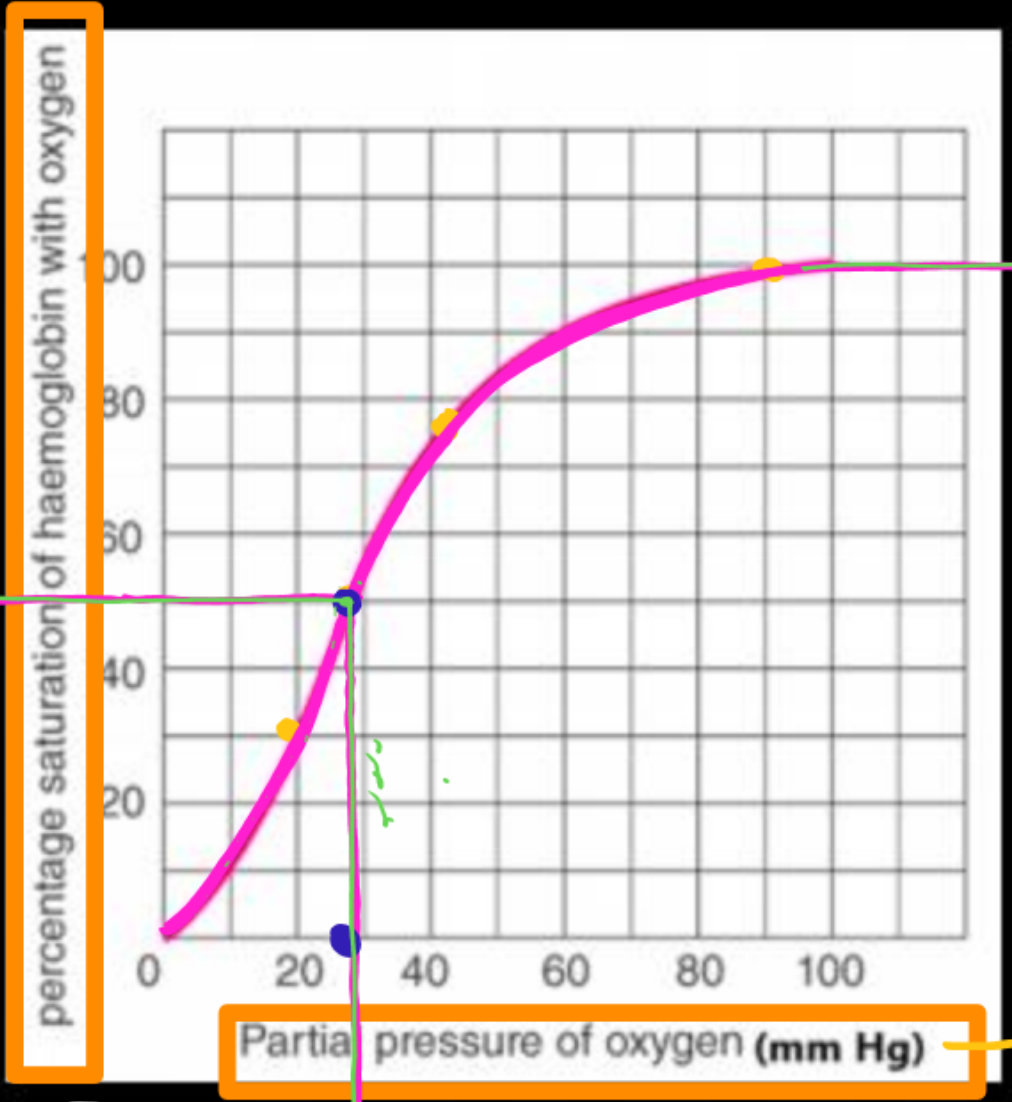
(Resting Condition)
(Strenous Condition)
5ml O2
[Cell]
15ml
oxy. blood
100 ml → 20ml O2
100 ml – 20ml O2
C6H12O6
O2
O2
20 ml O2
20ml
4 ml CO2
CO2 + E
100 ml
100 ml
Deoxy blood
O2 = 15 ml
CO2 = 4 ml
Per 100 ml of blood
14ml CO2
O2 = 5ml
CO2 = 14 ml

Oxygen Haemoglobin Dissociation Curve

Sigmoid Curve / Bohr's Effect

S-Shape

% Saturation of Hb-O_2



50%

Partial Pressure of O_2

25 O_2 — Hb — O_2 100

50 O_2 — Hb — O_2 75

P_{50}-Value = Partial Pressure of O_2 at 50% Hb-O_2 Saturated

26 mmHg

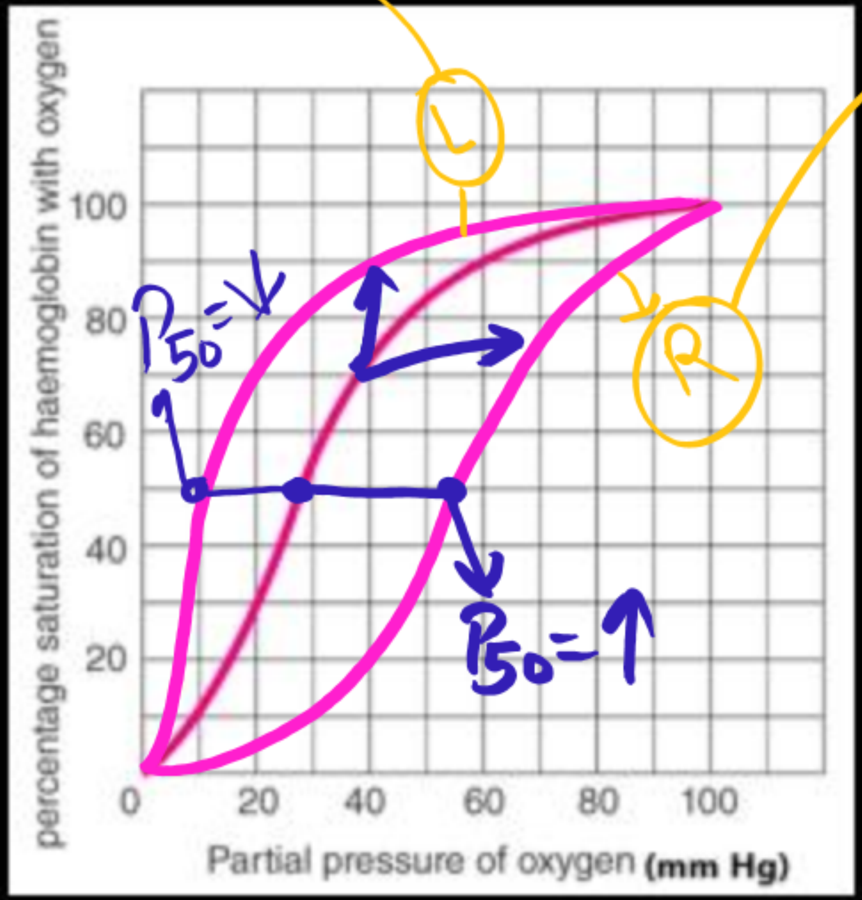
[Left Shift]

[Favourable Condition]

→ $Hb\text{-}O_2$ Association

(Haldane Effect)

- $P_{O_2} = \uparrow$ & $P_{CO_2} = \downarrow$
- $H^+ = \downarrow$ & $PH = \uparrow$
- $P_{50} = \downarrow$
- Temp. = ↓
- Near lungs.



[Right Shift]

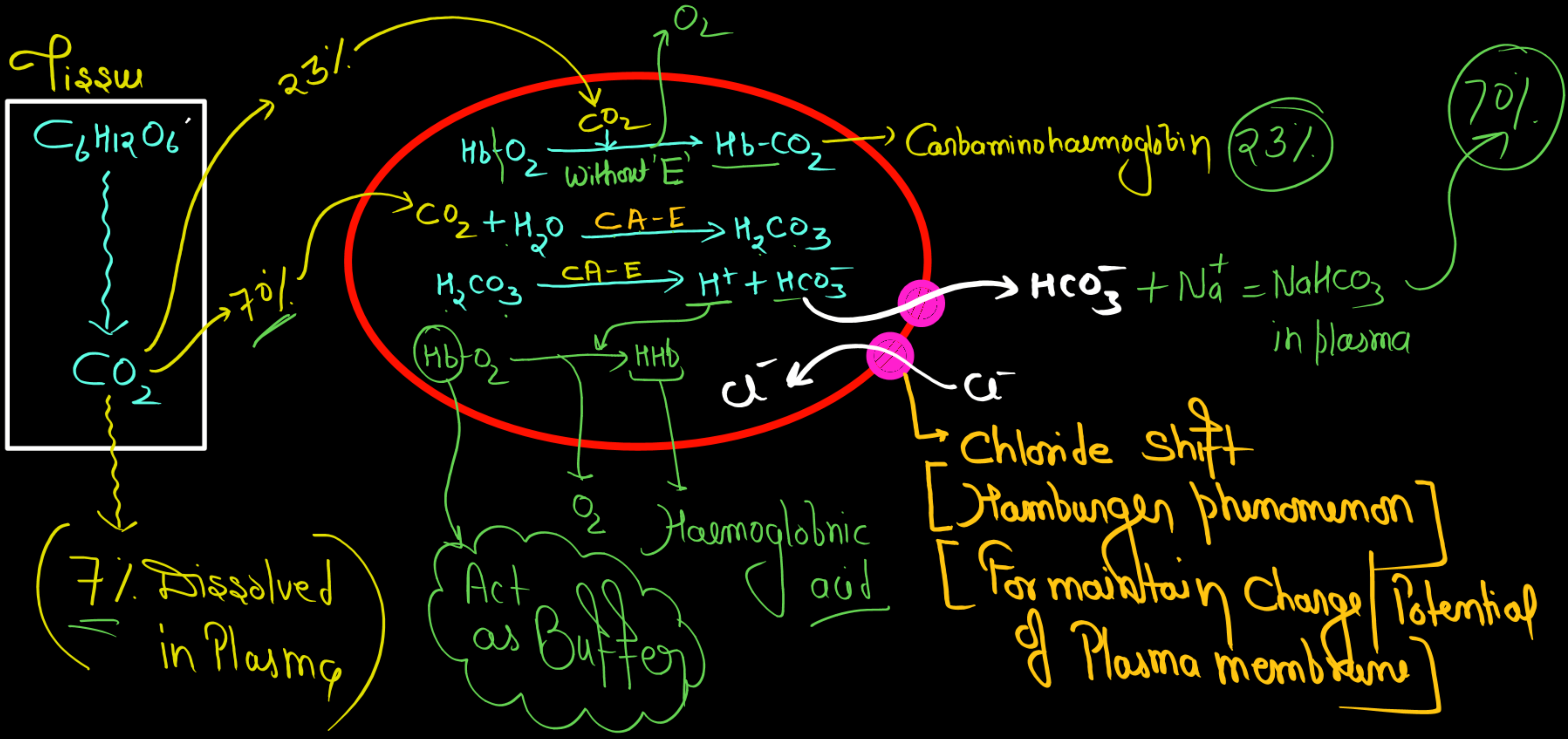
[Unfavourable Condition]

→ $Hb\text{-}O_2$ = Dissociation

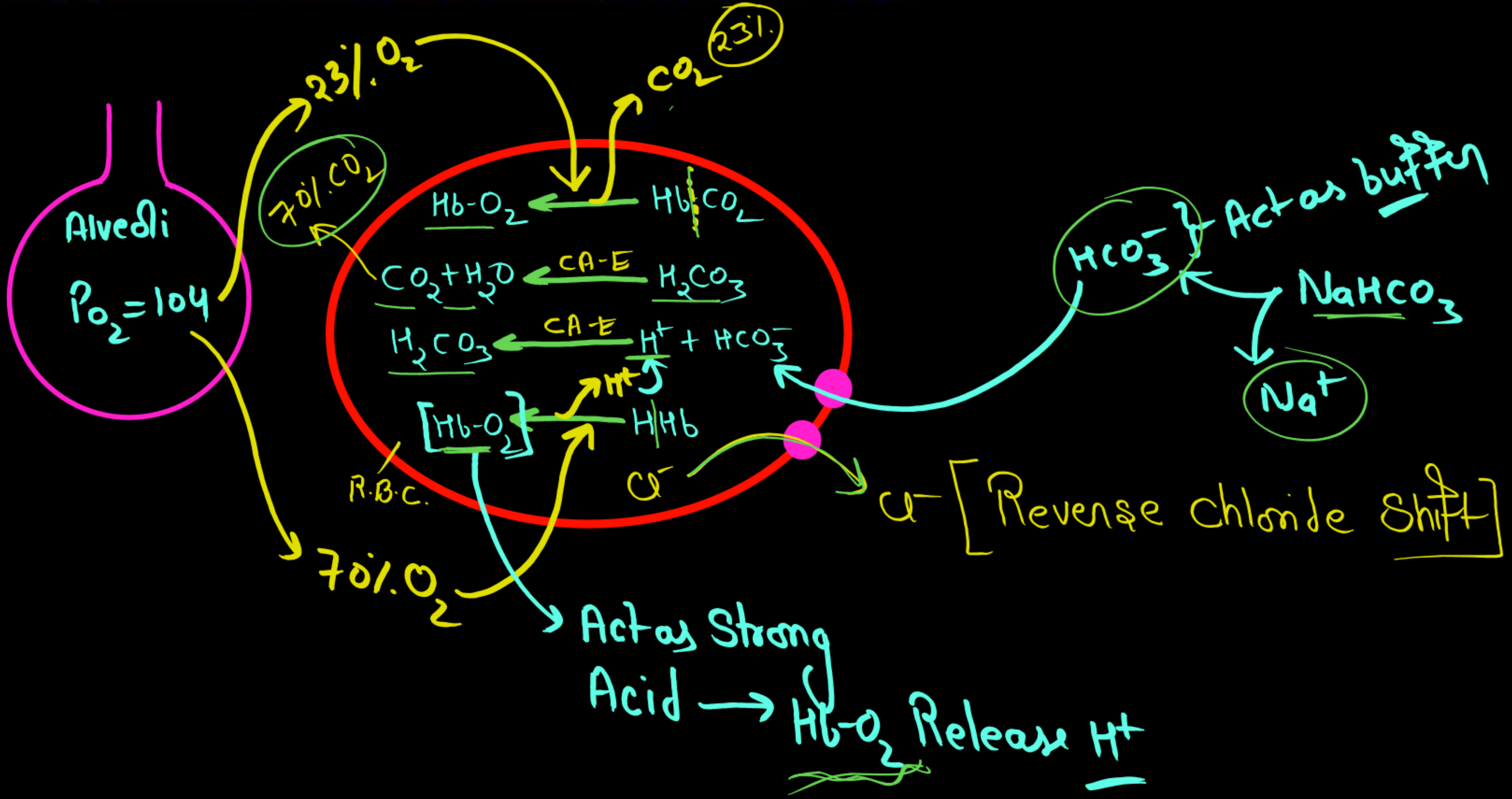
(Bohr Effect)

- $P_{O_2} = \downarrow$ & $P_{CO_2} = \uparrow$
- $H^+ = \uparrow$ & $PH = \downarrow$
- $P_{50} = \uparrow$
- Temp. = ↑
- Near Tissue

(1) Loading of CO2 (Near Tissue)



(2) Unloading of CO2 (Near Alveoli)



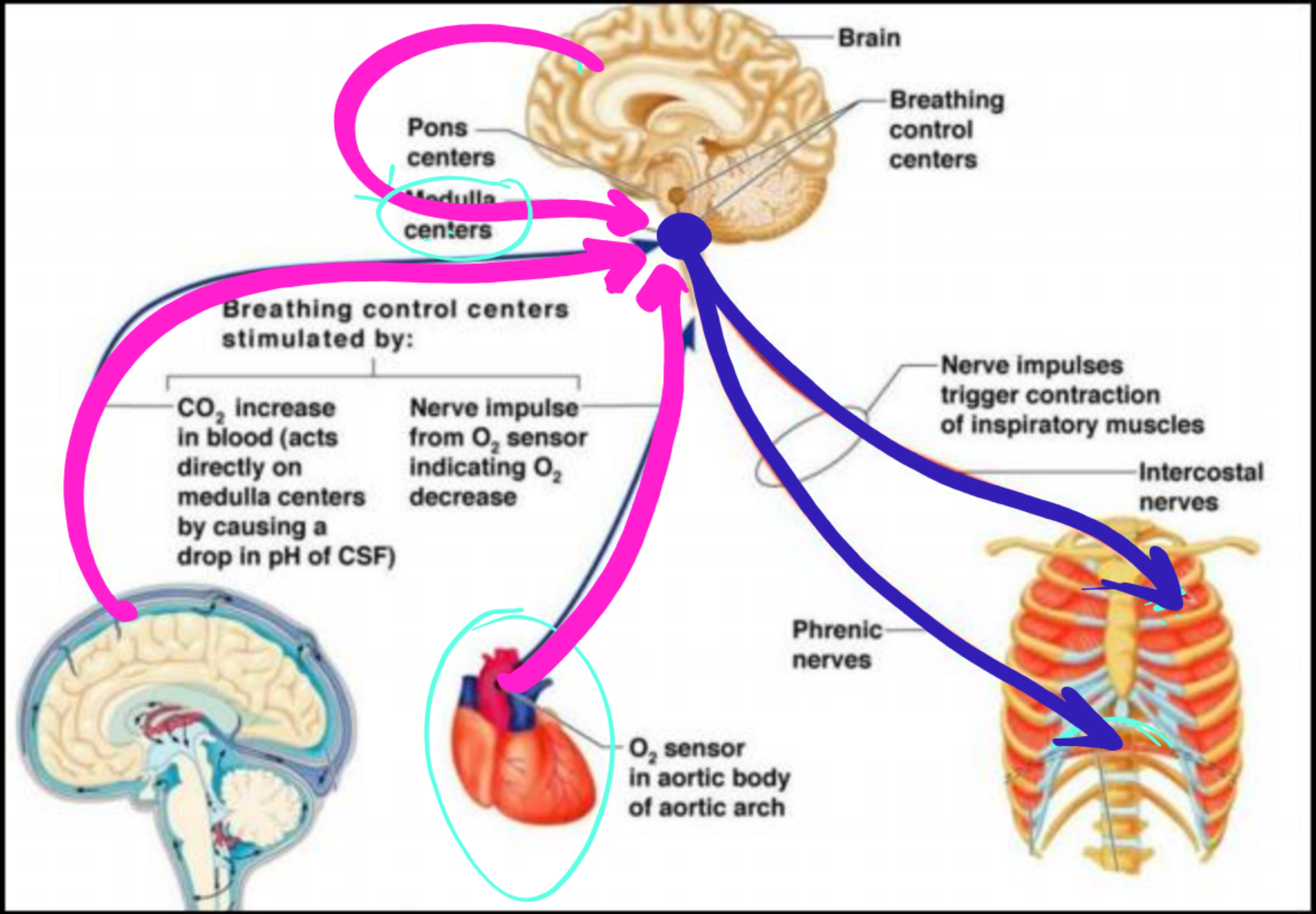
1) [Carbonic anhydrase - Enzyme] → ↑nt in
- R.B.C
- Some amount in Plasma

A = Tissue →

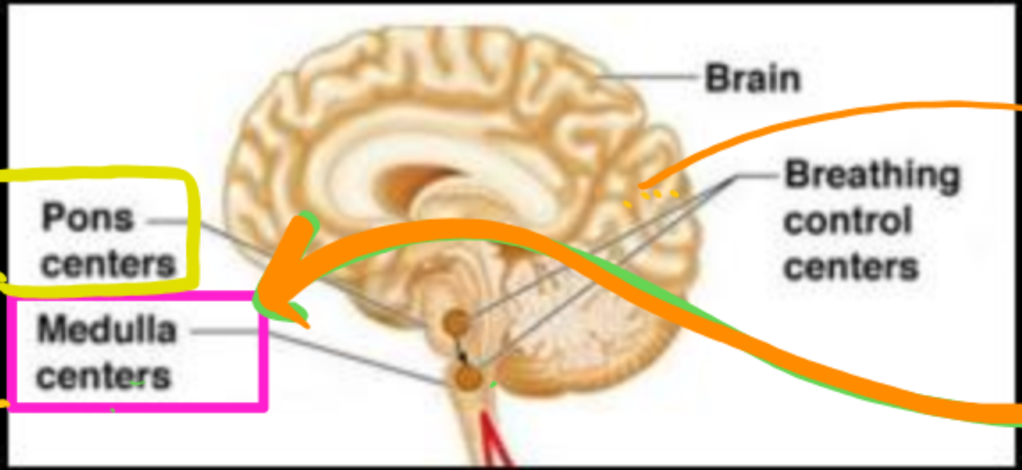
2) - $CO_2 + H_2O \underset{CA}{\overset{CA}{\rightleftharpoons}} H_2CO_3 \underset{CA}{\overset{CA}{\rightleftharpoons}} H^+ + HCO_3^-$

← B = lungs

Regulation of Breathing



Nervous Regulation of Breathing



Cerebrum → Voluntary Breathing

(M.O.) ← [Involuntary Breathing]

DRG = Dorsal Respiratory Group } Normal Breathing
- [Inspiratory - Area]
- → Respiratory Rhythm Center
- → Control only - Inspiration by - Contration of
  - E.I.C.M.
  - Diaphragm Mus.

VRG = Ventral Respiratory Group } Forceful Brea.
- [Expiratory Area]
- → Control Contraction of
  - → I.I.C.M
  - Abdominal Muscle

Regulation by Pons →

↳ Switch off - Center (Pneumotaxic Center)

— Stop Inspiration only for ≤ 5 Sec

if Pneumotaxic Center Hyper active ⟶ ↓ Duration of Inspiration

⇓

↑ - Rate of breathing

Chemical Regulation of Breathing

- [Based on Chemo-receptors, Sensitive for < H^+, CO_2]

[Central chemoreceptor]

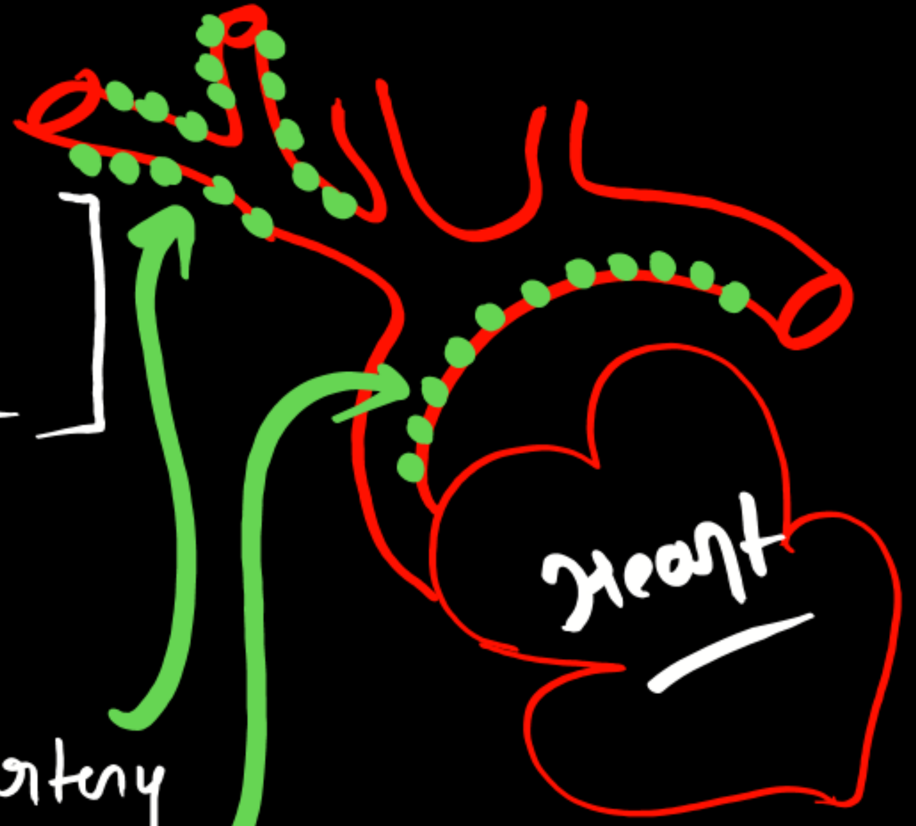
[+nt near the brain or]

if H^+ & CO_2 ↑ in C.S.F.

[Periphernal-chemo.]

+nt in < Carotid artery, Aorta.

if H^+ & CO_2 ↑ in Blood

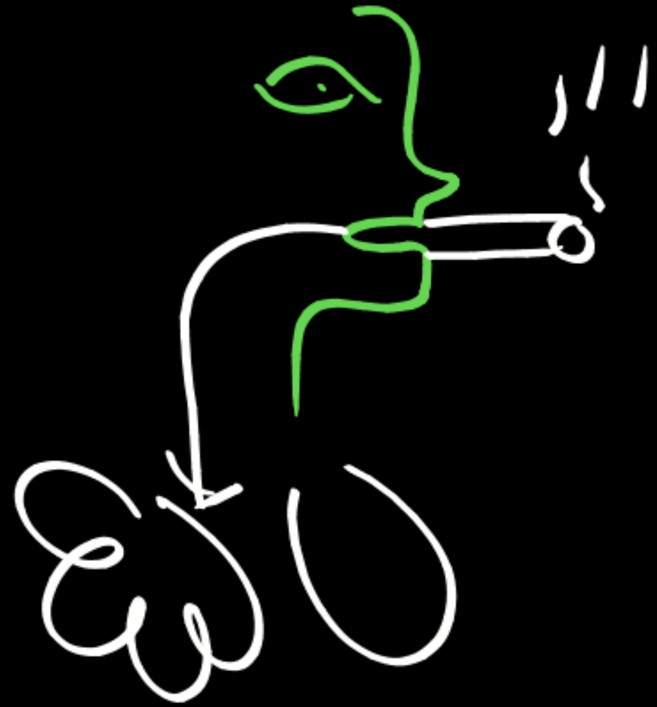


[M.O.] → ↑ Rate of Breathing

DISORDERS OF RESPIRATORY SYSTEM

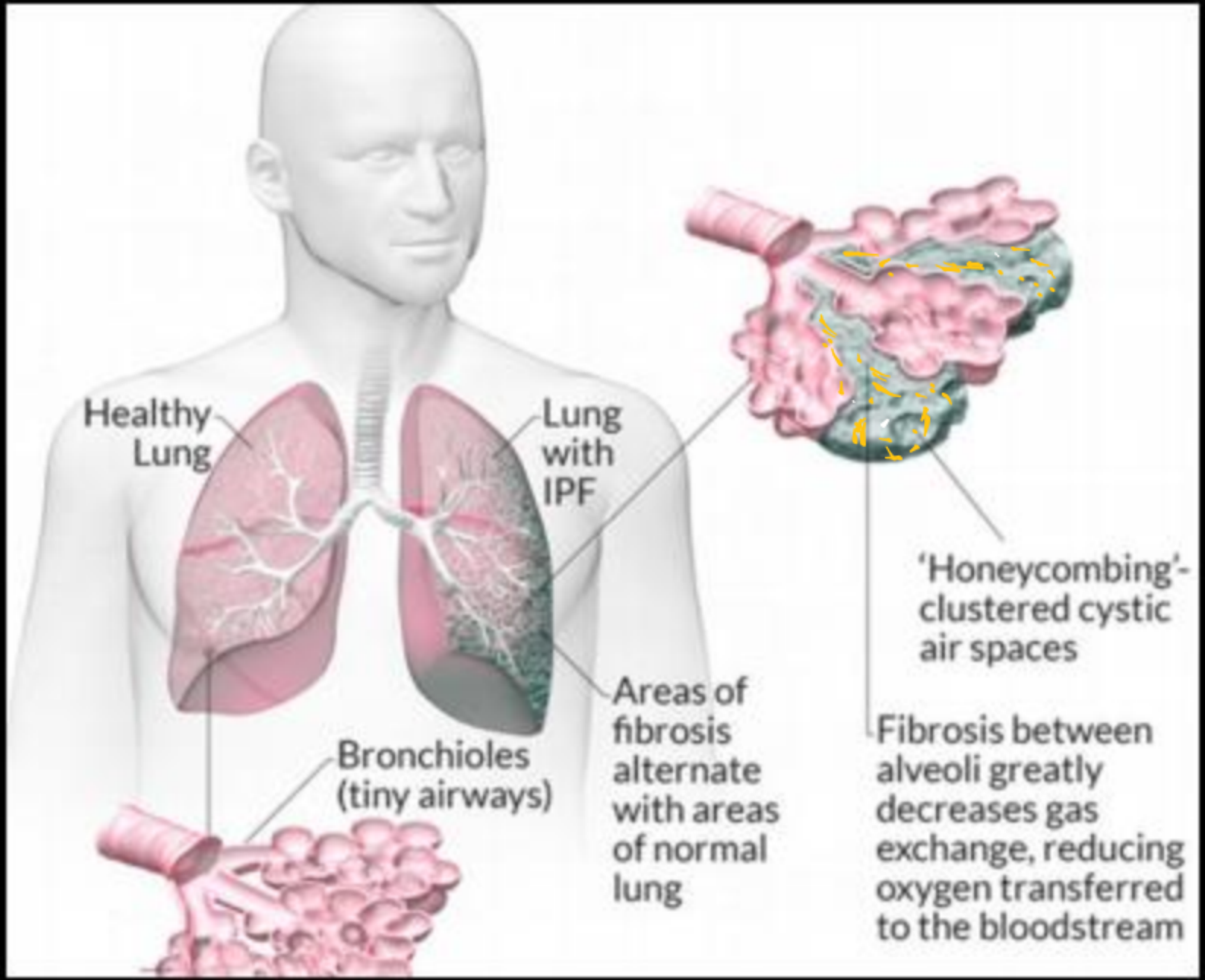
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(3) Occupational Respiratory Disorders:

In certain industries, especially those involving grinding or stone-breaking, so much dust is produced that the defense mechanism of the body cannot fully cope with the situation. Long exposure can give rise to **inflammation leading to fibrosis (proliferation of fibrous tissues) and thus causing serious lung damage.** Workers in such industries should wear protective masks.



Pneumoconiosis - Pneumoconiosis is a term that can refer to any chronic lung condition caused by the inhalation of dust or toxic fibers.

Coal worker Pneumoconiosis – Caused by inhalation of coal dust.

Silicosis - Caused by the inhalation of silica dust

Asbestosis - Caused by the inhalation of asbestos.

Byssinosis - Caused by the inhalation of cotton fibers.

Think Positively and Positive Things Will Happen

THANK YOU

MANTHAN NEET 2025

BODY FLUIDS AND CIRCULATION

LECTURE -1

ZOOLOGY

MD SIR



TODAY'S GOAL

Blood

Circulatory system

1. Circulating fluid - Blood, Lymph

2. Blood vessels - Arteries, Capillaries, Veins and Portal System.

3. Pumping device – Heart





Blood

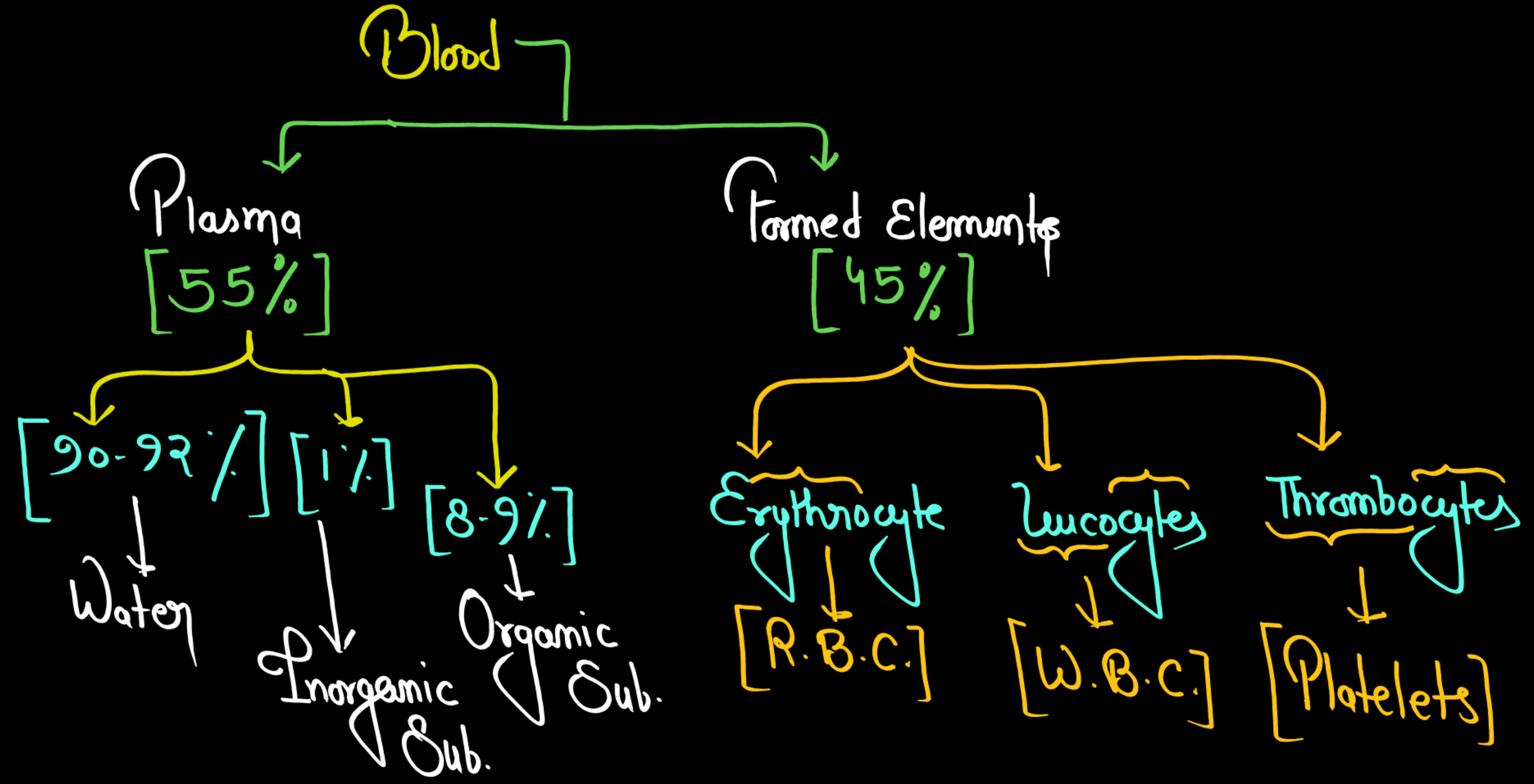
BLOOD

= Fluid Connective Tissue (Mesodermal)

- Volume of blood –
  - Male – 5 l
  - Female – 4.5 l
- ECF- 15 l [Blood forms 33% of Extra Cellular Fluid)
- pH of blood - 7.2 — 7.4

7.2 → Veins: $CO_2 = \uparrow = H^+ \uparrow$ → $PH = \downarrow$

7.4 → Artery: $CO_2 = \downarrow = H^+ = \downarrow$ → $PH = \uparrow$



Blood
Plasma
[55%]
Formed Elements
[45%]
[90-92%]
Water
[1%]
Inorganic Sub.
[8-9%]
Organic Sub.
Erythrocyte
[R.B.C.]
Leucocytes
[W.B.C.]
Thrombocytes
[Platelets]

Note

Plasma = Blood − Cells

Serum = Plasma − Clotting factors

Lymph = Blood − {R.B.C + Platelets + Macroprotein

Plasma (55%)

(A) Inorganic Sub. (1 %)

→ Salts = NaCl, HCO_3^- } Act as buffer

→ Ions = $Cl^- > Na^+ > K^+ > Ca^{++} > Mg^{++}$

Cl^- ↓ Max^m

Mg^{++} ↓ Min^m

(B) Organic Sub. (8-9 %) –

Note = All blood protein formed by – Liver Except = γ-globulin [By – Plasma cells]

(1) Proteins (6-8 %)

Albumin (Max^m)
- Smallest
- Formed by Liver
- Function = Osmoregulation

Prothrombin & Fibrinogen } Min^m
- Largest
- Formed by Liver
- Blood Clotting

Globulin
- α-globulin
- β-globulin
  - (α and β) → Liver
  - (α and β) → Binding & Transport
- γ-globulin (Antibody)
  - ↓ [Immunoglobulin]
  - → Defense Mechanism
  - Formed by – Plasma cells

2)- Sugar = Normal Value = 100 mg/DL.

- level = ↓ = Hypoglycemia
- level = ↑ = Hyperglycemia

3)- Cholesterol = Normal Value = ≤ 150 mg/DL.

[30-mg/100 or]

4)- Urea = Normal Value = 20-40 mg/100 ml of blood

↑- Blood urea level → Uremia → Anaemia

(Change shape of R.B.C)

Formed Elements (45 %)

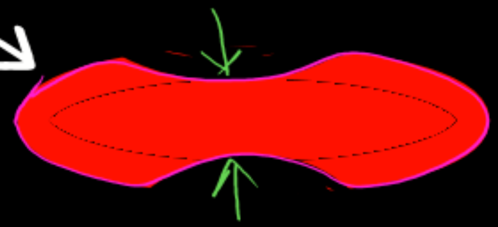
(Blood Cells)

(1) Erythrocytes (RBC)

- Mitochondria - nt
- Catabolic Reaction [Glycolysis] +nt (in cytoplasm)



No. of RBC – 5- 5.5 million / mm^3



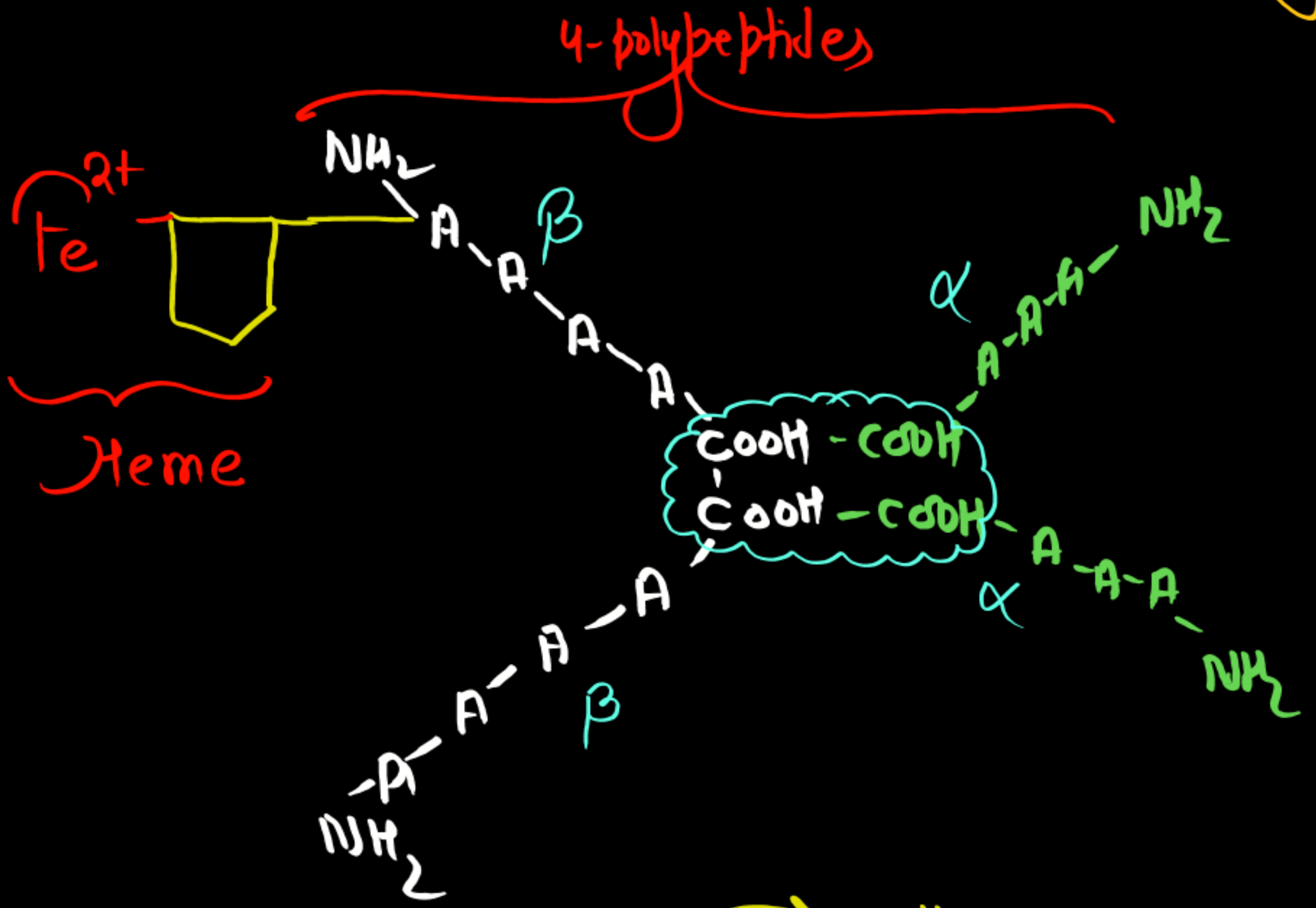
Size and Shape of RBC -

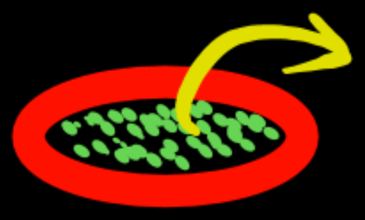
R.B.C. of Most of the Mammals are
- → Biconcave & Circular → ↑ - Surface area.
- → Without Nucleus → [Reduce utilization of O_2]

[Nucleus +nt in Immature R.B.C.]

Haemoglobin (Hb).

Amount = 15 gm / 100 ml of blood or 12-16 gm / 100 ml of blood





Millions Molecules tnt in Each R.B.C

H.b. = 4 - polypeptides

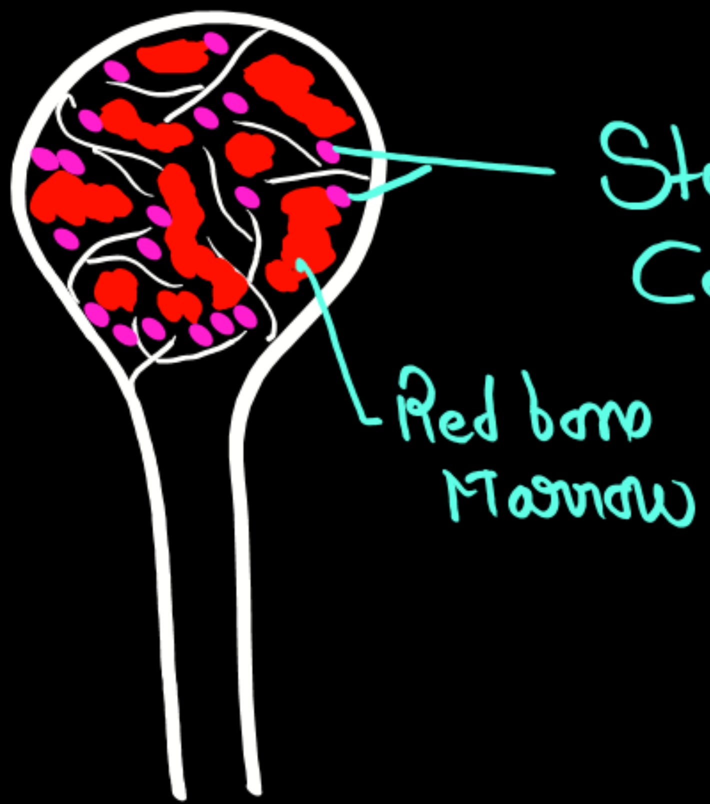
- 2α = 141 a.a.
- 2β = 146 a.a.

→ Heme [4%] + Globulin (Protein) [96%]

- Heme ↓ 4 — Porphyrin Rings + 4 — Fe^{2+}
- Globulin ↓ 4 - Polypeptides

Formation of RBC (Erythropoiesis)

- Embryo = Yolk Sac ------> Spleen & Liver
- Adult = Red bone marrow (tnt in long bones)



Stem Cells
- → Lucocytes (W.B.C)
- → Erythrocytes (R.B.C)
- → Megakaryocytes → (Platelets)

- Life Span of RBC = 120 days
- After 120 days – breakdown of RBC occur by macrophage in spleen etc. (Graveyard of RBC)

(Blood bank of R.B.C)

1. Blood, a special type of connective tissue
(A) Consists of a fluid matrix (Plasma)
(B) Has formed elements
(C) Is the most commonly used body fluid by most of the higher organisms
(D) All

2. Plasma is a straw coloured, viscous fluid constituting nearly ____ % of blood –
(A) 55 (b) 45
(C) 90 (D) 10

3. The amount of water present in blood plasma is –
(A) 99% (B) 90-92%
(C) 10% (D) 55%

4. Formed elements of blood include –
(A) RBC, WBC and blood platelets
(B) All solutes present in blood
(C) Proteins present in blood
(D) All minerals (elements)

5. Life span of human RBC is –
(A) 120 hours (B) 120 month
(C) 120 days (D) 102 days

6. What is the amount of haemoglobin present in 100 ml blood of human blood?
(A) 45g (B) 18-20g
(C) 12-16g (D) 10 -12g

(7) Mammalian RBCs are in shape-

(A) Oval (B) Biconvex
(C) biconcave (D) Sickle like

(8) Globulins contained in human blood plasma are primarily involved in

(1) Osmotic balance of body fluids
(2) Oxygen transport in the blood
(3) Clotting of blood
(4) Defense mechanisms of body

(9) I. Plasma contains very high amount of minerals like Na^+, Ca^{2+}, Mg^+, HCO_3^-, Cl^-
II. Glucose, amino acids, lipids etc. are present in the plasma as they are not always in transit in the body
III. Factors for clotting of blood are present in plasma in an active form
IV. Plasma without the clotting factors is called serum

Find the correct one regarding the above statement

(1) Only I is incorrect (2) Only II is correct
(3) IV is correct (4) All are incorrect

THANK YOU !!

MANTHAN NEET 2025

BODY FLUIDS AND CIRCULATION

LECTURE -2



ZOOLOGY

MD SIR

TODAY'S GOAL

- Blood –WBC & Platelets
- **Blood Clotting**

1. Blood, a special type of connective tissue
(A) Consists of a fluid matrix (Plasma)
(B) Has formed elements
(C) Is the most commonly used body fluid by most of the higher organisms
(D) All

2. Plasma is a straw coloured, viscous fluid constituting nearly ____% of blood –
(A) 55 (b) 45
(C) 90 (D) 10

3. The amount of water present in blood plasma is –
(A) 99% (B) 90-92%
(C) 10% (D) 55%

4. Formed elements of blood include –
(A) RBC, WBC and blood platelets
(B) All solutes present in blood
(C) Proteins present in blood
(D) All minerals (elements)

A

5. Life span of human RBC is –
(A) 120 hours (B) 120 month
(C) 120 days (D) 102 days

C

6. What is the amount of haemoglobin present in 100 ml blood of human blood?
(A) 45g (B) 18-20g
(C) 12-16g (D) 10 -12g

C

(7) Mammalian RBCs are in shape-

(A) Oval

(B) Biconvex

(C) biconcave

(D) Sickle like

C

(8) Globulins contained in human blood plasma are primarily involved in

(1) Osmotic balance of body fluids
(2) Oxygen transport in the blood
(3) Clotting of blood
(4) Defense mechanisms of body

4

(9) I. Plasma contains very high amount of minerals like Na+, Ca2+, Mg+, HCO3–, Cl–
II. Glucose, amino acids, lipids etc. are present in the plasma as they are not always in transit in the body
III. Factors for clotting of blood are present in plasma in an active form
IV. Plasma without the clotting factors is called serum

Find the correct one regarding the above statement

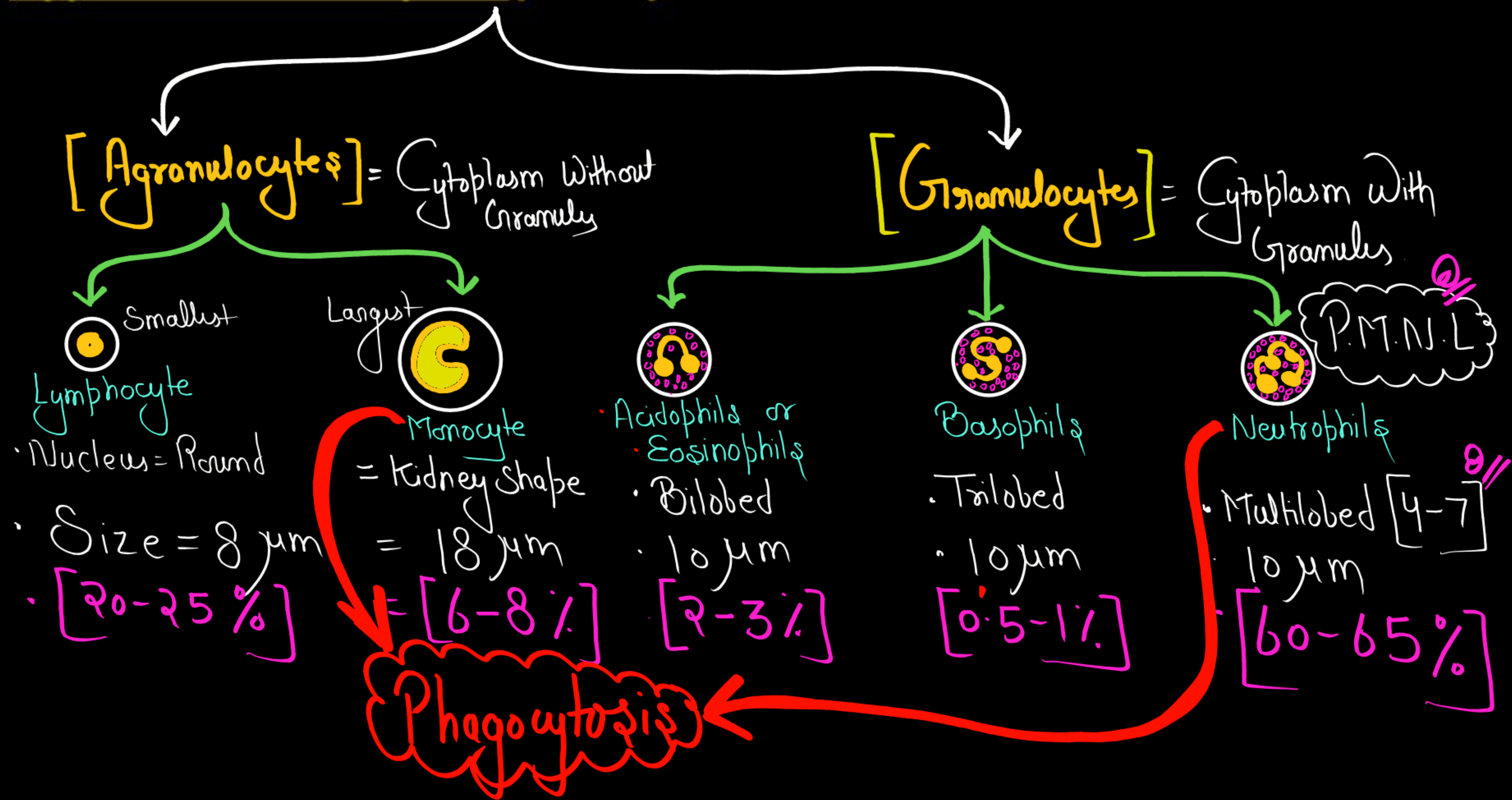
(1) Only I is incorrect
(2) Only II is correct
(3) IV is correct
(4) All are incorrect

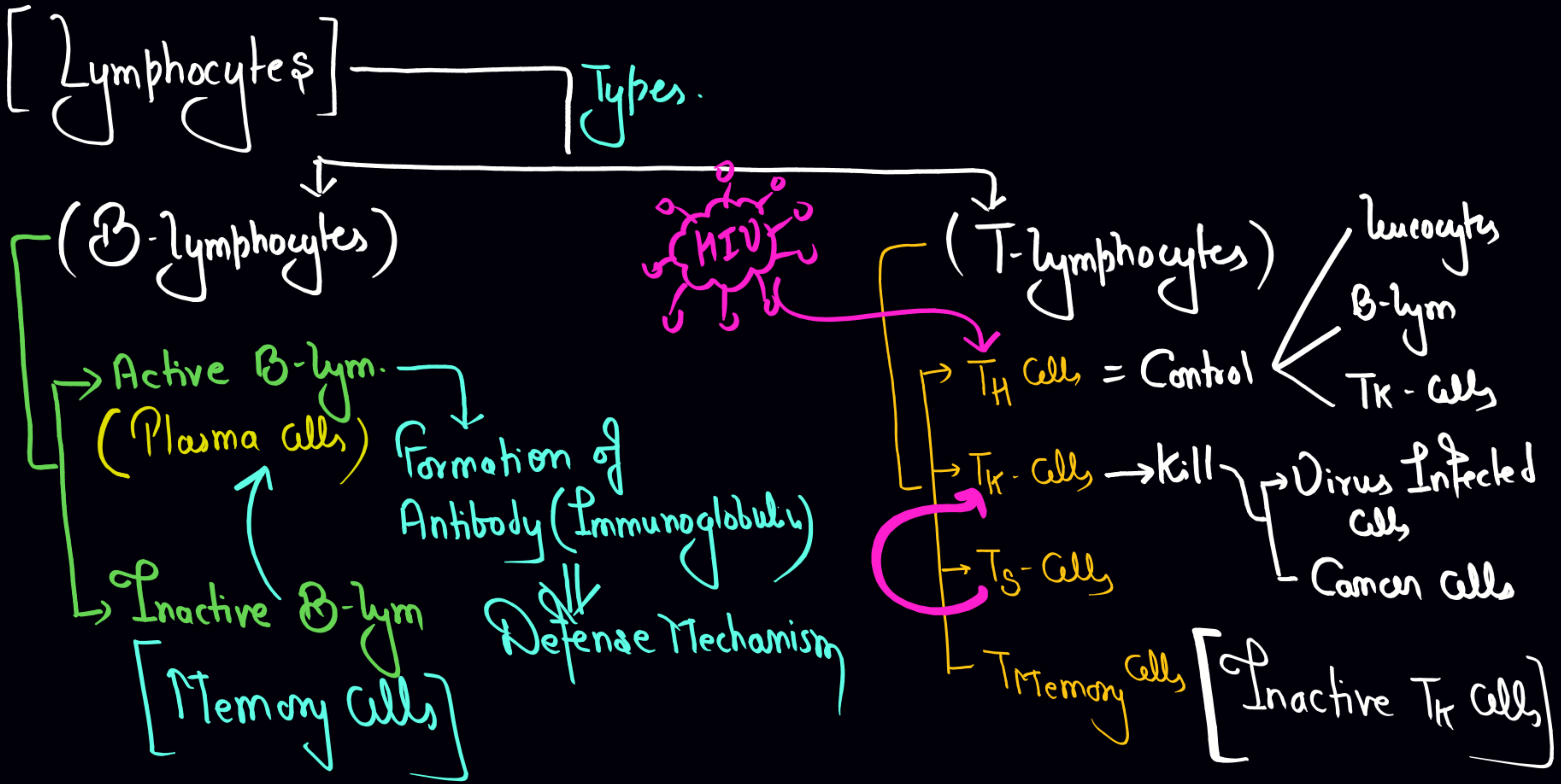
3

Leucocytes (WBC)

- * No. of W.B.C = 6000 - 8000/mm^3 of blood
- * Leucocytosis = ↑ - W.B.C Count due to infection
- * Leukaemia = ↑ - W.B.C Count due to Blood Cancer
- * Life Span = hours - Year

Types of Leucocytes (WBC) -





[Lymphocytes]
Types.
(B-lymphocytes)
HIV
(T-lymphocytes)
Active B-lym.
(Plasma cells)
Formation of Antibody (Immunoglobulin)
Defense Mechanism
Inactive B-lym
[Memory cells]
T_H cells = Control
leucocytes
B-lym
T_K - cells
T_K - cells → Kill
Virus Infected cells
Cancer cells
T_S - cells
T_M Memory cells
[Inactive T_K cells]

Eosinophils



- * Antiparacytic granules ✓
- * Antiallergic granules
  - ↓ Contain
  - (Histaminase Enzymes → Antiallergic)

Allergy Causing Histamine → Inactive

Associated With Allergic Reaction — NCERT

Basophils



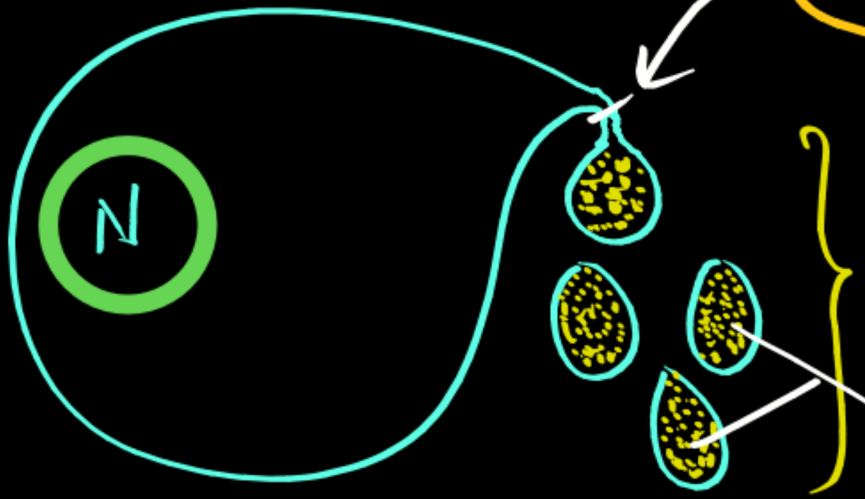
Release ↓

1) - Histamine → Vasodilation during Inflamation
2) - Heparin → Anti coagulent
3) - Serotonin → Vasoconstricter

Involve in Inflamatory Reaction — NCERT

Thrombocytes (Platelets)

* Only +nt in Mammalian blood.
* No. = 1,50,000 – 3,50,000 Lakh/mm^3
* Produced by ⇒ Fragmentation of Megakaryocytes



Platelets →
- Without Nucleus
- Oval / Round Shape
- Contain Thromboplastin etc.

Thromboplastin

* Life Span = One Week
* Function = Blood Clotting
* Thrombocytopenia → ↓ Platelete Count

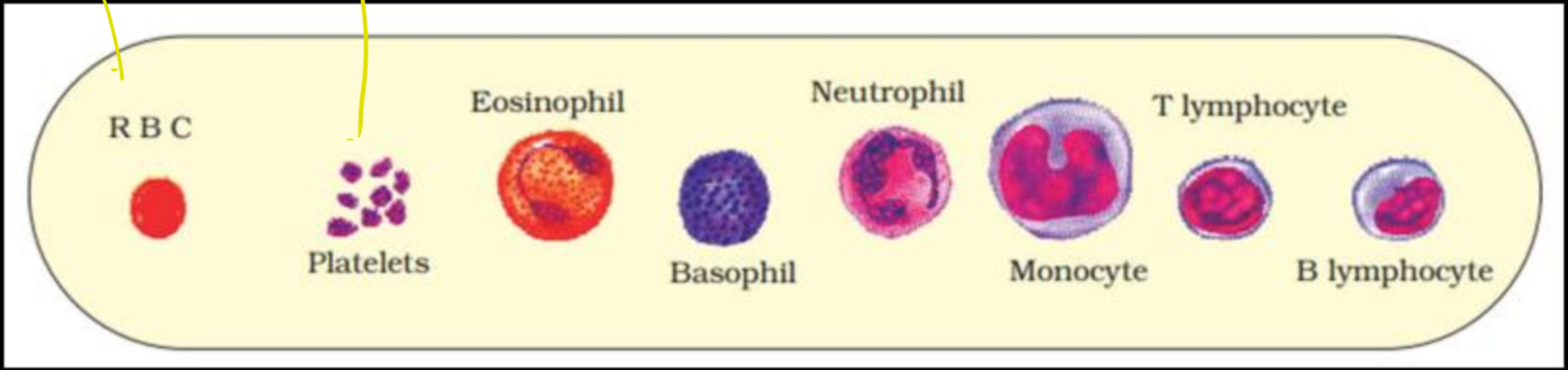
R.B.C > Platelets > W.B.C (6000-8000)

5-5.5 million

1.5-3.5 lakh

Neutrophils > Lymphocyte > Monocytes > Eosino. > Baso.

(60-65%) (20-25%) (6-8%) (2-3%) (0.5-1%)



Which of the following is **incorrect** match of WBCs with its functions :

(1) Neutrophils	=	Phagocytic cells
(2) Eosinophils	=	Resist infections and are also associated with alergic reactions
(3) Basophils	=	Secrete histamine serotonin and Heparin
(4) T-Lymphocytes	=	Produce antibodies

Match the **column-I** with **column-II** :

	Column-I		Column-II
A	Neutrophil	(i)	6-8%
B	Basophil	(ii)	20-25%
C	Lymphocytes	(iii)	2-3%
D	Monocytes	(iv)	60-65%
E	Eosinophills	(v)	0.5-1%

Options :

(1) **A**-(iv), **B**-(v), **C**-(ii), **D**-(i), **E**-(iii)

(2) **A**-(v), **B**-(iii), **C**-(iv), **D**-(ii), **E**-(i)

(3) **A**-(iv), **B**-(ii), **C**-(v), **D**-(iii), **E**-(i)

(4) **A**-(ii), **B**-(i), **C**-(iii), **D**-(iv), **E**-(v)

(3)

In the column-I blood component and in the column -II their specific functions are given :

	Blood component	Specific functions
(A)	Globulin protein	Involved in defense mechanism of body
(B)	Fibrinogen protein	Needed for clotting of blood
(C)	Albumin protein	Role in the transport of gases
(D)	Basophils WBC	Involved in inflammatory reactions
(E)	Eosinophils WBC	Help in osmotic balance
(F)	Lymphocytes WBC	Responsible for immune responses of the body

How many are correctly matched ?

(1) Four (2) Three

(3) Five (4) Six

Which of the following is **not** correct identification and matching w.r.t. diagrammatic representation of cells and their function?

	Cell	Function
(1)	 Neutrophil	Phagocytic cells which destroy foreign organisms entering the body
(2)	 Basophil	Secrete histamine, serotonin and heparin and are involved in inflammatory reactions
(3)	 Eosinophil	Can resist interactions and make allergic reactions more severe
(4)	 Monocytes	Phagocytic cells

5 Agranulocytes are

(1) Eosinophils and neutrophils
(2) Monocytes and lymphocytes
(3) Eosinophils and lymphocytes
(4) Lymphocytes and basophils

6 Process by which blood cells are formed in bone marrow

(1) Haemopoiesis
(2) Haemolysis
(3) Thromobopoesis
(4) Erythroblastosis

7 Mammalian mature RBCs does not contain

(1) Membrane bounded cell organelles
(2) Carbonic anhydrase
(3) Haemoglobin
(4) Enzyme of glycolytic pathway

X Which of the following statement are correct?

I. Ca^{+2} is necessary for blood coagulation

II. Coagulation in blood vessel is prevented during normal condition by heparin

III. Clotting of blood involves changes of fibrinogen to fibrin by thrombin

IV Blood clotting involves cascading process involving a number of factors present in the active form always

(A) I, III, IV (B) II, IV

(C) I, II, III (D) III, IV

8 Find the correct descending order of percentage proportion of leucocytes in human blood.

(A) Neutrophils → Basophils → Lymphocytes → Acidophils (Eosinophils) → Monocytes

(B) Neutrophils → Monocytes → Lymphocytes → Acidophils → Basophils

(C) Neutrophils → Lymphocytes → Monocytes → Acidophils → Basophils

(D) Neutrophils → Acidophils → Basophils → Lymphocytes → Monocytes

THANK YOU !!

MANTHAN NEET 2025

BODY FLUIDS AND CIRCULATION

LECTURE -3

ZOOLOGY

MD SIR



TODAY'S GOAL

- Blood Clotting
- Blood Group
- Lymph
- Circulatory Pathway

Which of the following is **incorrect** match of WBCs with its functions :

(1) Neutrophils = Phagocytic cells

(2) Eosinophils = Resist infections and are also associated with alergic reactions

(3) Basophils = Secrete histamine serotonin and Heparin

(4) T-Lymphocytes = Produce antibodies

B-lym.

(4)

Match the column-I with column-II :

	Column-I		Column-II
A	Neutrophil	(i)	6-8%
B	Basophil	(ii)	20-25%
C	Lymphocytes	(iii)	2-3%
D	Monocytes	(iv)	60-65%
E	Eosinophills	(v)	0.5-1%

Options :

(1) **A**-(iv), **B**-(v), **C**-(ii), **D**-(i), **E**-(iii)

(2) **A**-(v), **B**-(iii), **C**-(iv), **D**-(ii), **E**-(i)

(3) **A**-(iv), **B**-(ii), **C**-(v), **D**-(iii), **E**-(i)

(4) **A**-(ii), **B**-(i), **C**-(iii), **D**-(iv), **E**-(v)

In the column-I blood component and in the column -II their specific functions are given :

	Blood component	Specific functions
(A)	Globulin protein	Involved in defense mechanism of body
(B)	Fibrinogen protein	Needed for clotting of blood
(C)	Albumin protein	Role in the transport of gases
(D)	Basophils WBC	Involved in inflammatory reactions
(E)	Eosinophils WBC	Help in osmotic balance
(F)	Lymphocytes WBC	Responsible for immune responses of the body

How many are correctly matched ?

(1) Four
(2) Three
(3) Five
(4) Six

Which of the following is **not** correct identification and matching w.r.t. diagrammatic representation of cells and their function?

	Cell	Function
(1)	 Neutrophil	Phagocytic cells which destroy foreign organisms entering the body
(2)	 Basophil	Secrete histamine, serotonin and heparin and are involved in inflammatory reactions
(3)	 Eosinophil	Can resist interactions and make allergic reactions more severe
(4)	 Monocytes	Phagocytic cells

Agranulocytes are
(1) Eosinophils and neutrophils
(2) Monocytes and lymphocytes
(3) Eosinophils and lymphocytes
(4) Lymphocytes and basophils

2

Process by which blood cells are formed in bone marrow
(1) Haemopoiesis
(2) Haemolysis
(3) Thromobopoesis
(4) Erythroblastosis

1

Mammalian mature RBCs does not contain
(1) Membrane bounded cell organelles
(2) Carbonic anhydrase
(3) Haemoglobin
(4) Enzyme of glycolytic pathway

Find the correct descending order of percentage proportion of leucocytes in human blood.

(A) Neutrophils → Basophils → Lymphocytes → Acidophils (Eosinophils) → Monocytes

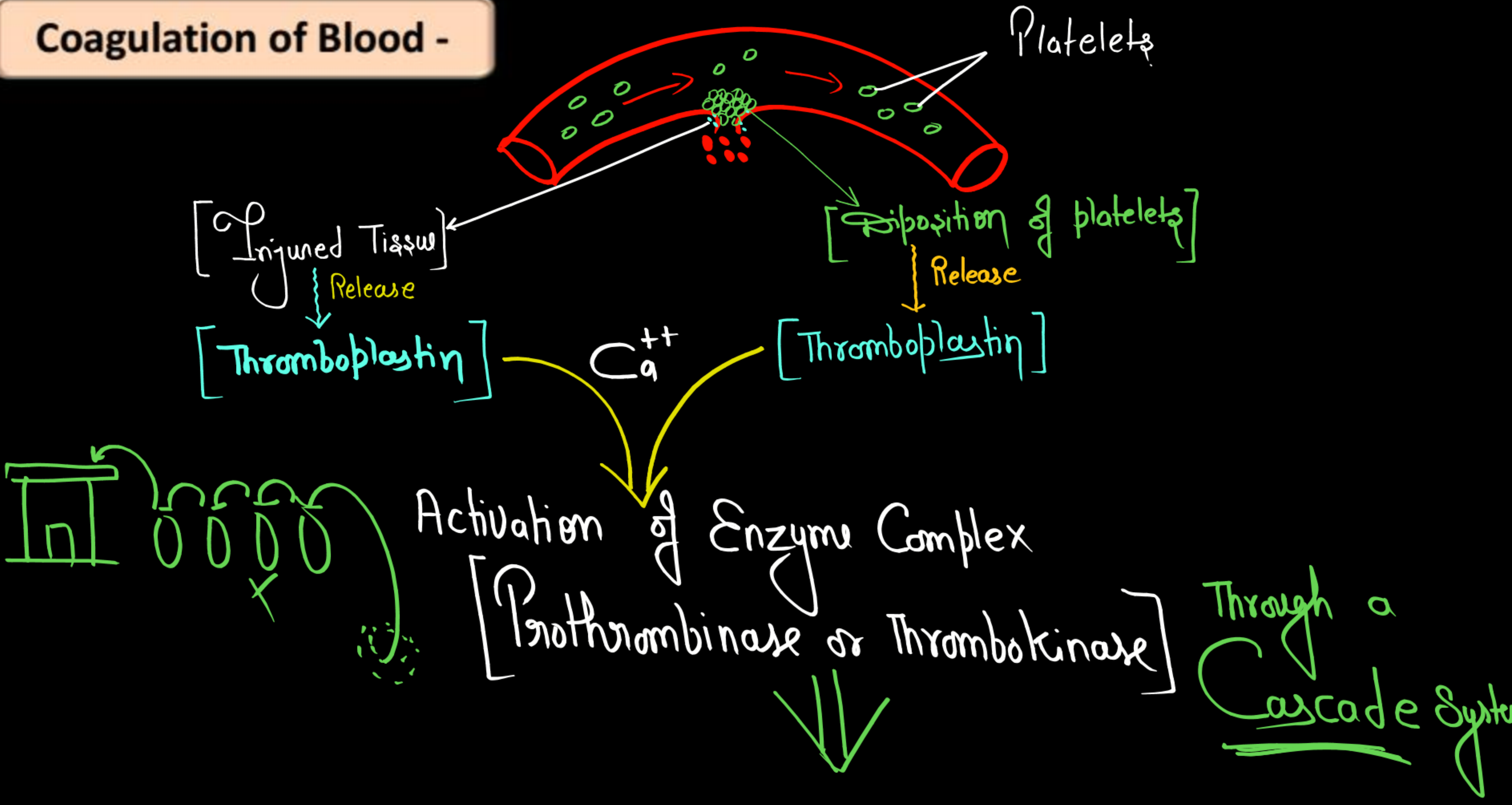
(B) Neutrophils → Monocytes →Lymphocytes→ Acidophils → Basophils

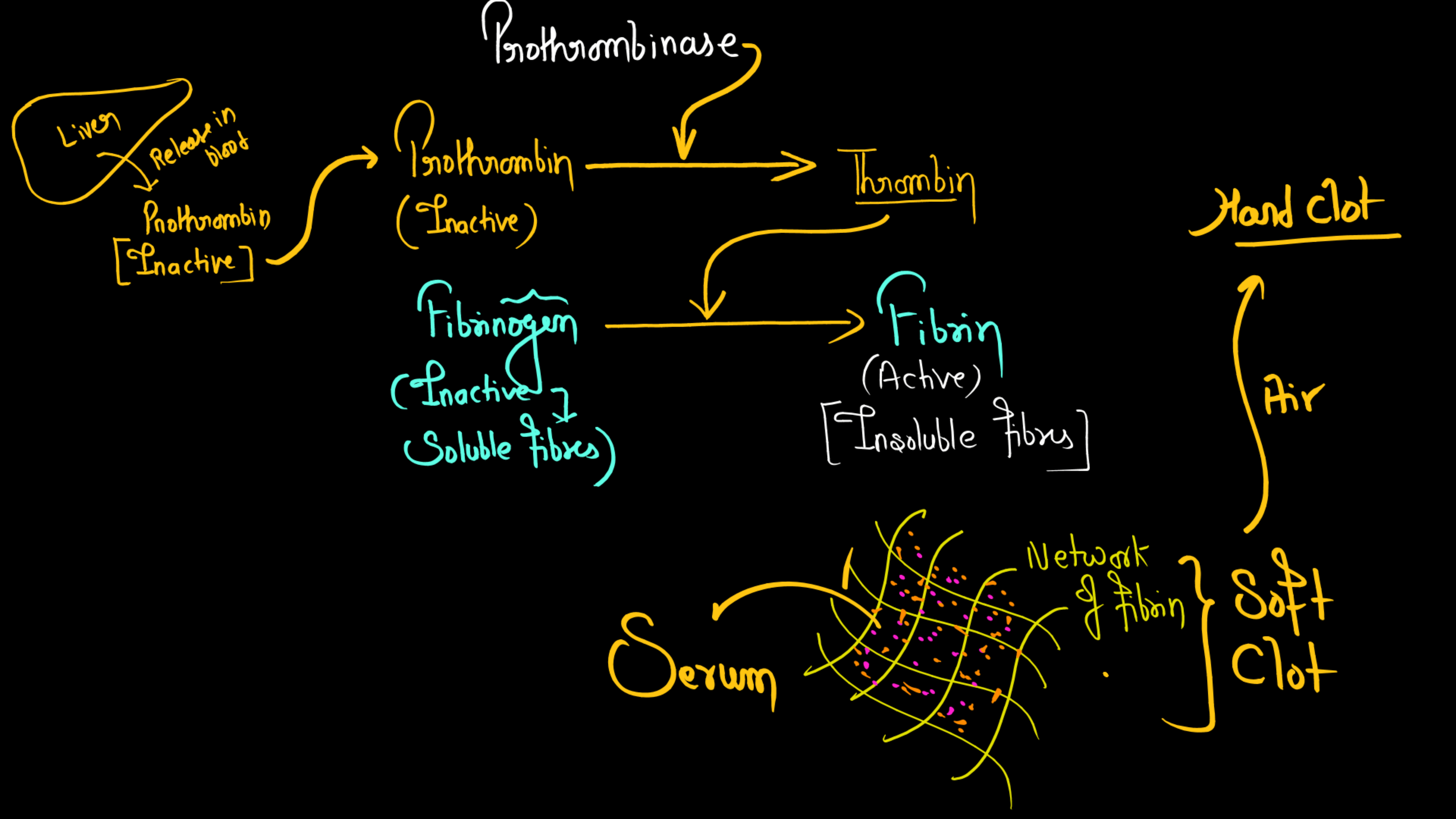
(C) Neutrophils →Lymphocytes→ Monocytes → Acidophils → Basophils

(D) Neutrophils → Acidophils → Basophils → Lymphocytes → Monocytes

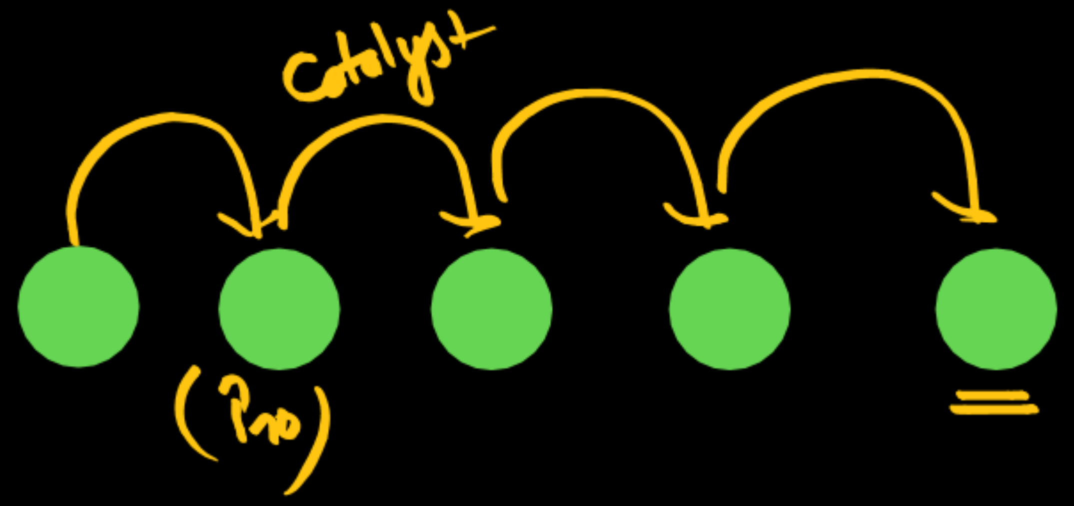
(C)

Coagulation of Blood -




Prothrombinase
Liver
Release in blood
Prothrombin
[Inactive]
Prothrombin
(Inactive)
Thrombin
Hard Clot
Fibrinogen
(Inactive)
(Soluble fibres)
Fibrin
(Active)
[Insoluble fibres]
Air
Network of fibrin
Soft Clot
Serum

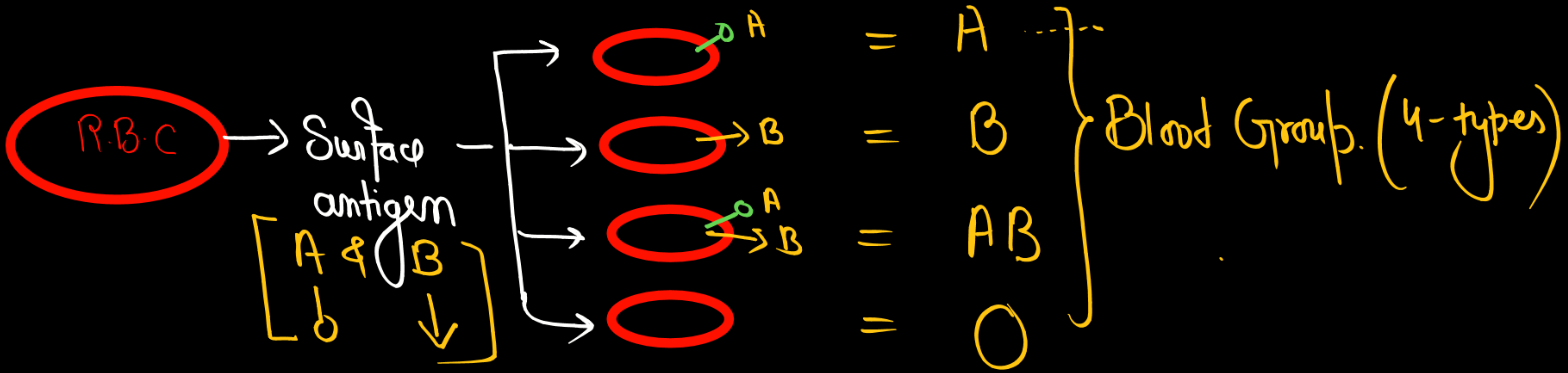
- It is a sequence of responses that stops bleeding, called cascade system (where each product act as catalyst for next step)
- In this reaction 13 clotting factors are involve.
- Calcium ions play a very important role in clotting.

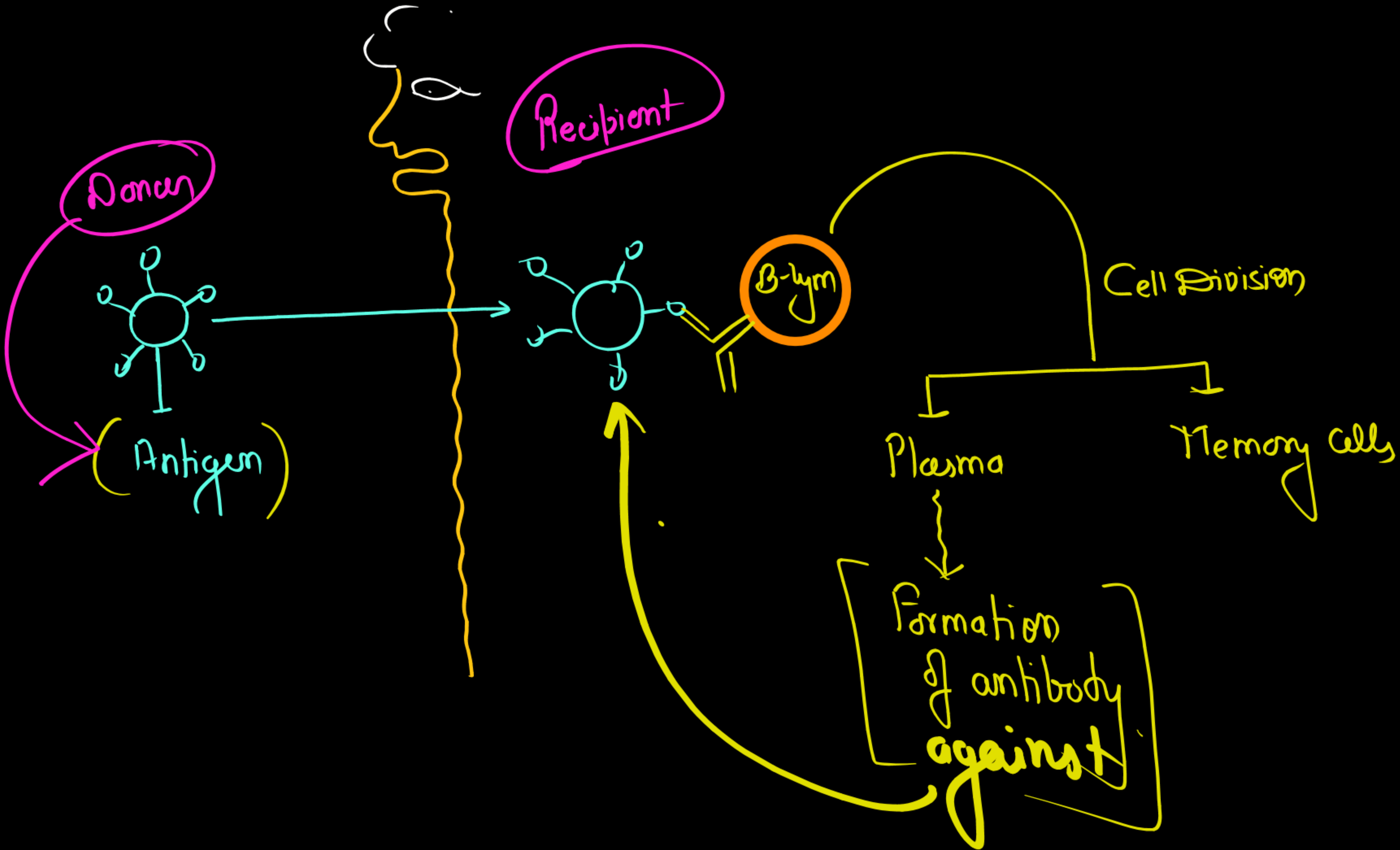


Blood Groups

(1) ABO grouping-

- ABO grouping is based on the presence or absence of two surface antigens (chemicals that can induce immune response) on the RBCs namely A and B.
- Similarly, the plasma of different individuals contain two natural antibodies (proteins produced in response to antigens)

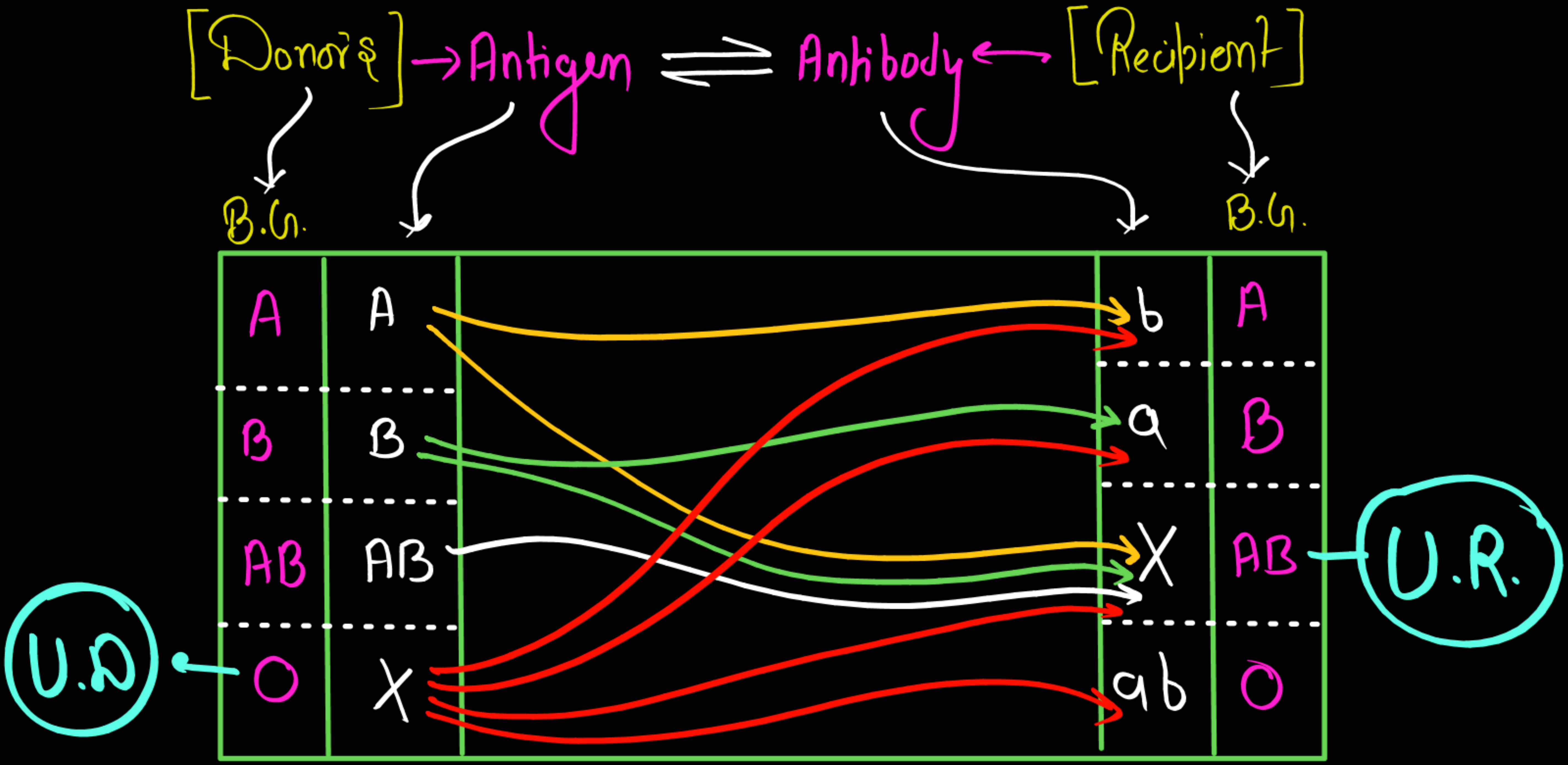



Donor
Recipient
Antigen
B-lym
Cell Division
Plasma
Memory cells
Formation of antibody against

The donor's compatibility

TABLE 18.1 Blood Groups and Donor Compatibility

Blood Group	Antigens on RBCs	Antibodies in Plasma	Donor's Group
A	A	anti-B	A, O
B	B	anti-A	B, O
AB	A, B	nil	AB, A, B, O
O	nil	anti-A, B	O



[Donors] → Antigen ⇌ Antibody ← [Recipient]
B.G.
B.G.
A
A
b
A
B
B
a
B
AB
AB
X
AB
O
X
ab
O
U.D.
U.R.

(2) Rh Grouping

- Rh antigen similar to one present in Rhesus monkeys (hence Rh), is also observed on the surface of RBCs of majority (nearly 80 per cent) of humans.

Human population →
- if Rh antigen +nt on R.B.C = Rh^{+ve} = 80%
- if Rh antigen -nt on R.B.C. = Rh^{-ve} = 20%

Note = Naturally antibody -nt in case of Rh blood Group.

Rh incompatibility (mismatching)

A special case of Rh incompatibility (mismatching) has been observed between the Rh-ve blood of a pregnant mother with Rh+ve blood of the foetus.

- Pregnant Mother (Rh−ve)
- Foetus (Rh+ve)

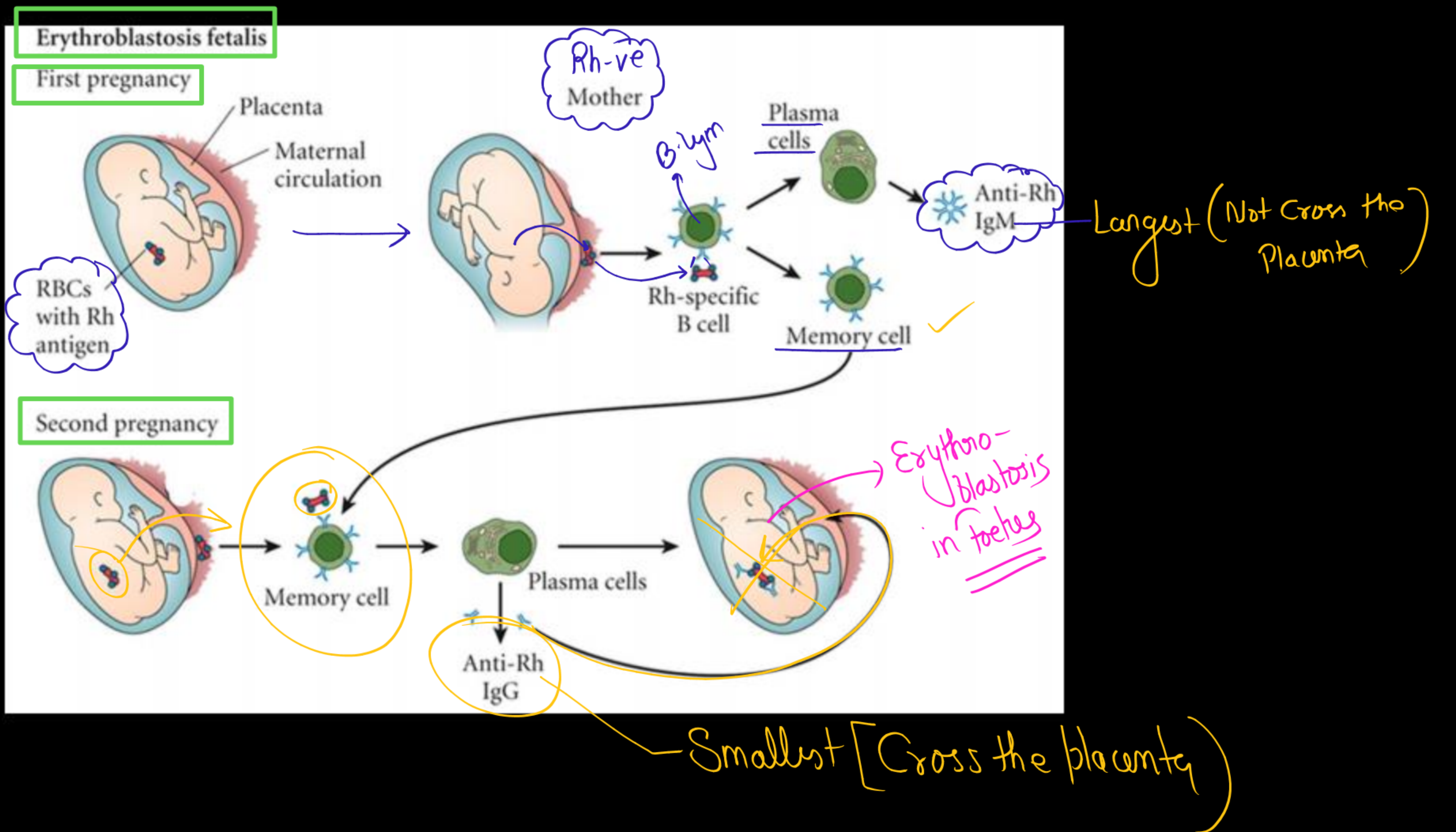
→ Ist baby Normal

↓

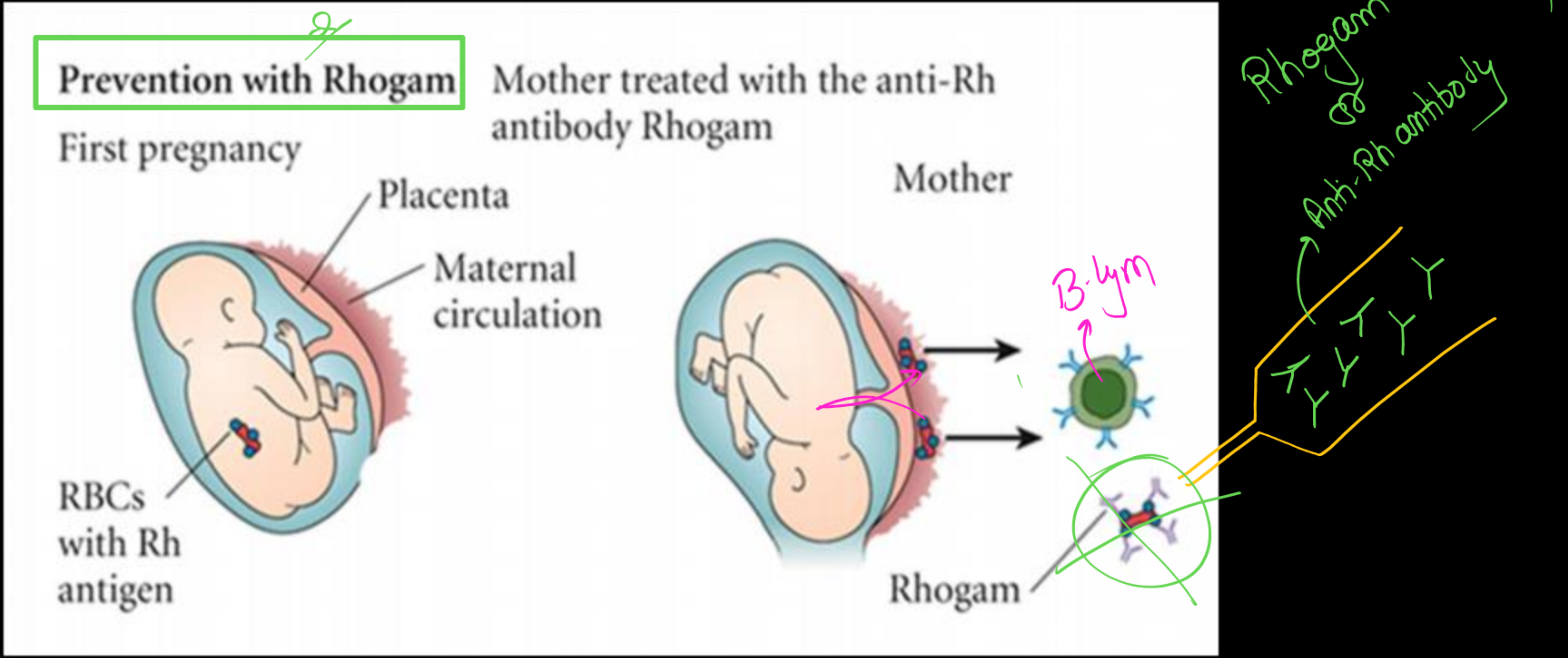
But - other (2nd, 3rd ...... etc)

- Show = Jaundice & Anaemia

(Erythroblastosis in Foetus)


Erythroblastosis fetalis
First pregnancy
Placenta
Maternal circulation
Rh-ve
Mother
RBCs with Rh antigen
B.lym
Rh-specific B cell
Plasma cells
Anti-Rh IgM
Memory cell
Largest (Not Cross the Placenta)
Second pregnancy
Memory cell
Plasma cells
Anti-Rh IgG
Erythro-blastosis in foetus
Smallest [Cross the placenta)

This can be avoided by administering anti-Rh antibodies to the mother immediately after the delivery of the first child.



1. Erythroblastosis foetalis can be avoided by administering _______ to the mother immediately after the delivery of first child

(1) Vitamins
(2) Antibiotics
(3) Anti-Rh antibodies
(4) Rh-antigen

2. ABO blood grouping is based on the presence or absence of surface antigens

(A) 2
(B) 3
(C) 6
(D) 12

3. Which of the following blood groups is universal donor and universal acceptors respectively?

(A) AB, O
(B) O, AB
(C) AB, A
(D) A, AB

4. In developing foetus, erythroblastosis foetalis is caused by-
(A) Haemolysis
(B) Clumping of RBCs
(C) Failure of blood clotting
(D) Phagocytosis by WBC.

5. . In erythroblastosis foetalis, which of the following factors passes through placenta into foetus -
(A) Rh antigens (B) Rh antibodies
(C) Agglutinins (D) ABO antibodies

6. . A doctor suggested to a couple not to have more than one child because of –
(A) Rh+ male and Rh- female
(B) Rh- male and Rh+ female
(C) Rh- male and Rh- female
(D) Rh+ male and Rh+ female

7. In case of emergency which blood group could be safely transfused?
(A) AB Rh- (B) AB Rh+
(C) O Rh- (D) O Rh+

8. Which of the following is expected if husband is Rh+ and wife is Rh-?
(A) No problem with 1st pregnancy
(B) Problem would be expected with future pregnancies
(C) Both
(D) No problem could be expected in any pregnancy

9. Which of the following statement are correct?
I. Ca+2 is necessary for blood coagulation
II. Coagulation in blood vessel is prevented during normal condition by heparin
III. Clotting of blood involves changes of fibrinogen to fibrin by thrombin
IV Blood clotting involves cascading process involving a number of factors present in the active form always
(A) I, III, IV
(B) II, IV
(C) I, II, III
(D) III, IV

10. Which of following statements is wrong about lymph.
I. Lymph is colourful as it has haemoglobin but no RBC
II. The fluid present in lymphatic system is called lymph
III. It contains specialized lymphocytes which are responsible for immunity of the body
IV. Lymph is an important carrier for nutrients and hormones

THANK YOU !!

MANTHAN NEET 2025

BODY FLUIDS AND CIRCULATION

LECTURE -4

ZOOLOGY

MD SIR



TODAY'S GOAL

- **Lymph**
- **Circulatory Pathway**
- Structure of Human Heart

1. Erythroblastosis foetalis can be avoided by administering ________ to the mother immediately after the delivery of first child

(1) Vitamins
(2) Antibiotics
(3) Anti-Rh antibodies
(4) Rh-antigen

2. ABO blood grouping is based on the presence or absence of surface antigens

(A) 2
(B) 3
(C) 6
(D) 12

3. Which of the following blood groups is universal donor and universal acceptors respectively?

(A) AB, O
(B) O, AB
(C) AB, A
(D) A, AB

4. In developing foetus, erythroblastosis foetalis is caused by-

(A) Haemolysis

(B) Clumping of RBCs

(C) Failure of blood clotting

(D) Phagocytosis by WBC.

5. . In erythroblastosis foetalis, which of the following factors passes through placenta into foetus -

(A) Rh antigens (B) Rh antibodies

(C) Agglutinins (D) ABO antibodies

6. A doctor suggested to a couple not to have more than one child because of –

(A) Rh+ male and Rh- female

(B) Rh- male and Rh+ female

(C) Rh- male and Rh- female

(D) Rh+ male and Rh+ female

7. In case of emergency which blood group could be safely transfused?

(A) AB Rh- (B) AB Rh+

(C) O Rh- (D) O Rh+

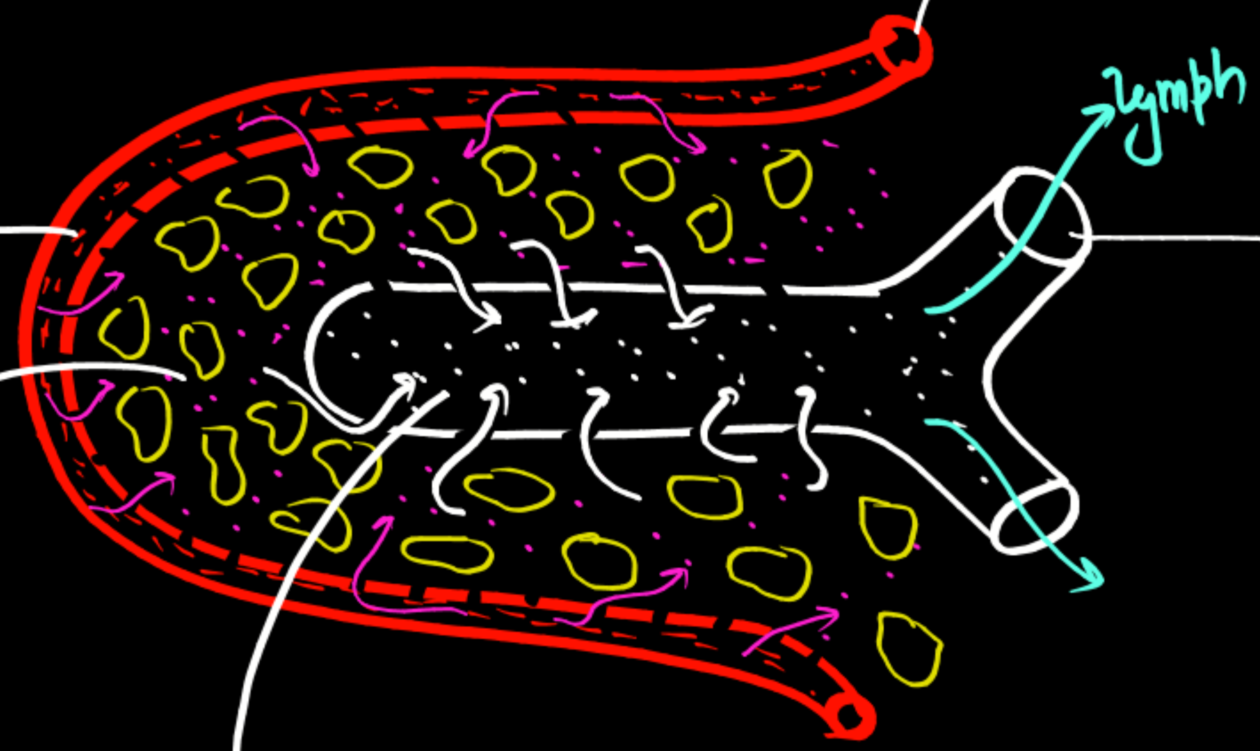
8. Which of the following is expected if husband is Rh+ and wife is Rh-?
(A) No problem with 1st pregnancy
(B) Problem would be expected with future pregnancies
(C) Both
(D) No problem could be expected in any pregnancy

9. Which of the following statement are correct?
I. Ca^{+2} is necessary for blood coagulation
II. Coagulation in blood vessel is prevented during normal condition by heparin
III. Clotting of blood involves changes of fibrinogen to fibrin by thrombin
IV Blood clotting involves cascading process involving a number of factors present in the active form always

(A) I, III, IV
(B) II, IV
(C) I, II, III
(D) III, IV

10. Which of following statements is wrong about lymph.
I. Lymph is colourful as it has haemoglobin but no RBC
II. The fluid present in lymphatic system is called lymph
III. It contains specialized lymphocytes which are responsible for immunity of the body
IV. Lymph is an important carrier for nutrients and hormones

Lymph - Blood Filtrate



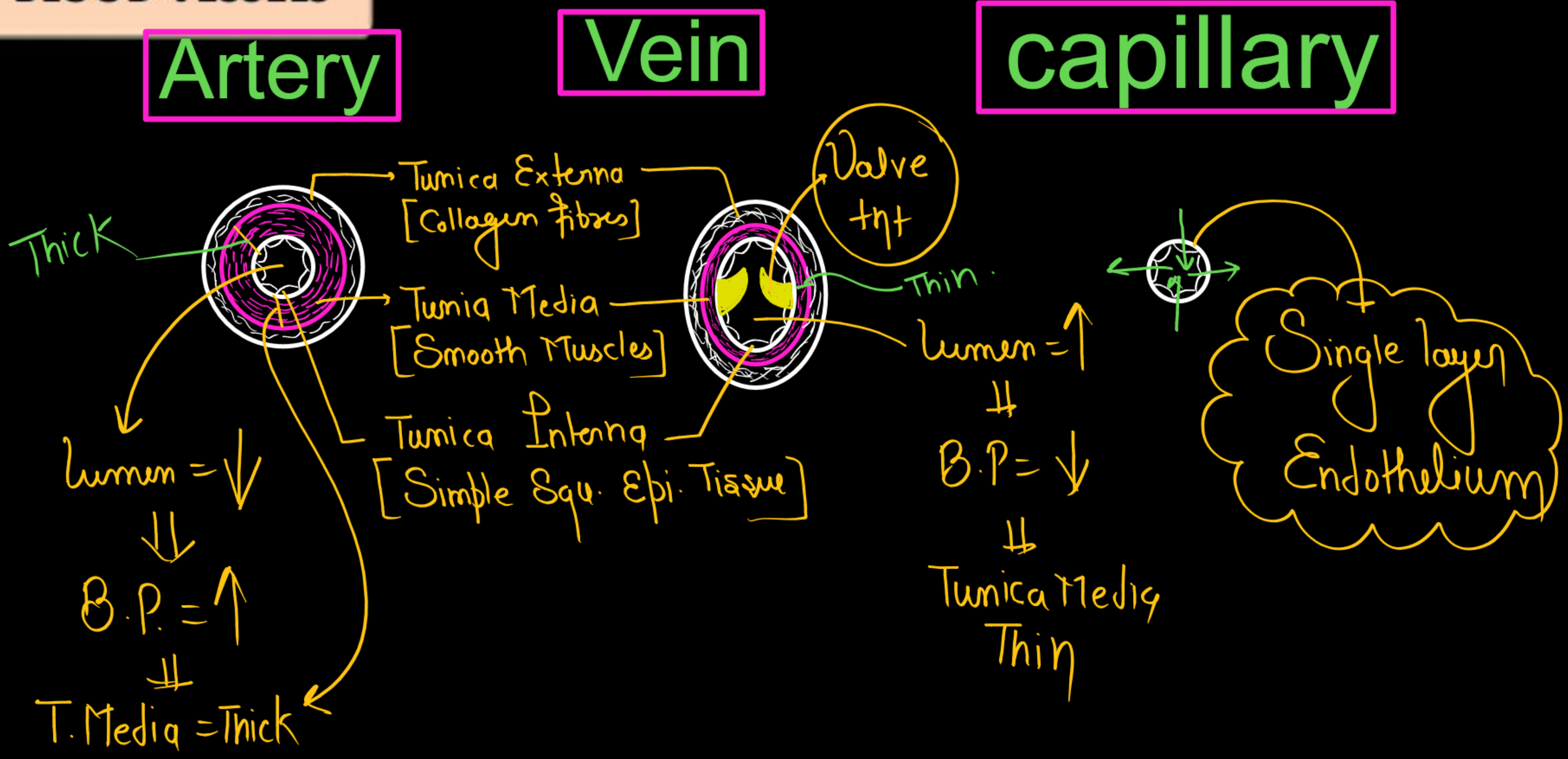
③ Lymph = Blood − R.B.C + Platelets + Macroprotein } → Act as Middle Man b/w Blood & Tissue for Transport of Nutrient, Hormones etc.

Lymph ↓ Microprotein + W.B.C } (imp)

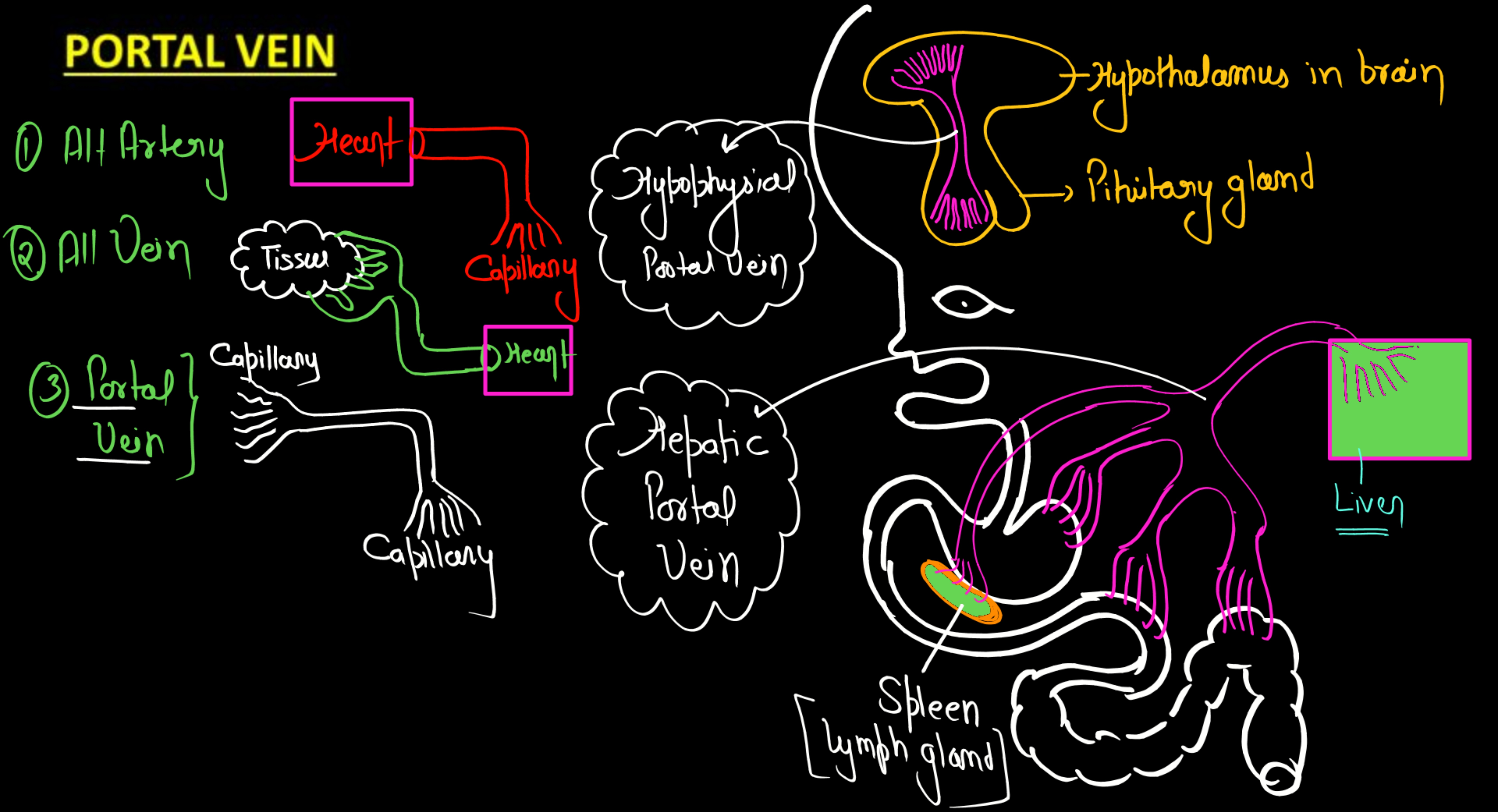
Difference between Lymph and Blood

Lymph	Blood
* Colour less	* Coloured
* R.B.C -nt (H.b. -nt)	* R.B.C. +nt, (H.b. +nt)
* Platelets -nt	* Platelets +nt
* Clotting Duration = long	* Clotting duration Short
* Protein less ≈ 4% [Albumin +nt]	* Protein More ≈ 7-8%
* W.B.C = More.	* W.B.C = less [6000-8000/mm^3]

BLOOD VESSELS



PORTAL VEIN

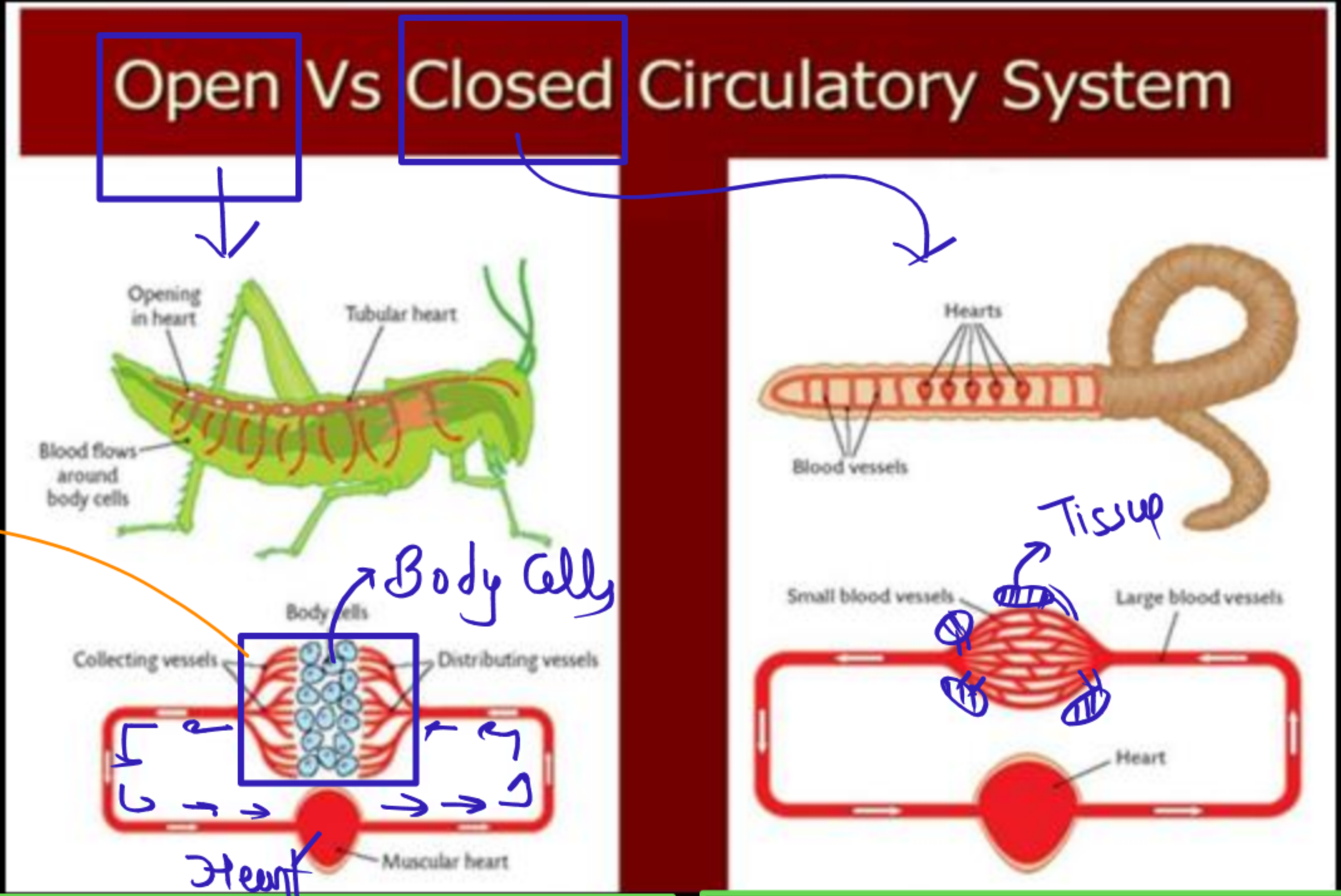


① All Artery
② All Vein
③ Portal Vein
Heart
Capillary
Tissue
Heart
Capillary
Capillary
Hypophysial Portal Vein
Hepatic Portal Vein
Hypothalamus in brain
Pituitary gland
Liver
Spleen
[lymph gland]

TYPES OF CIRCULATION

Tissue that in Cavity

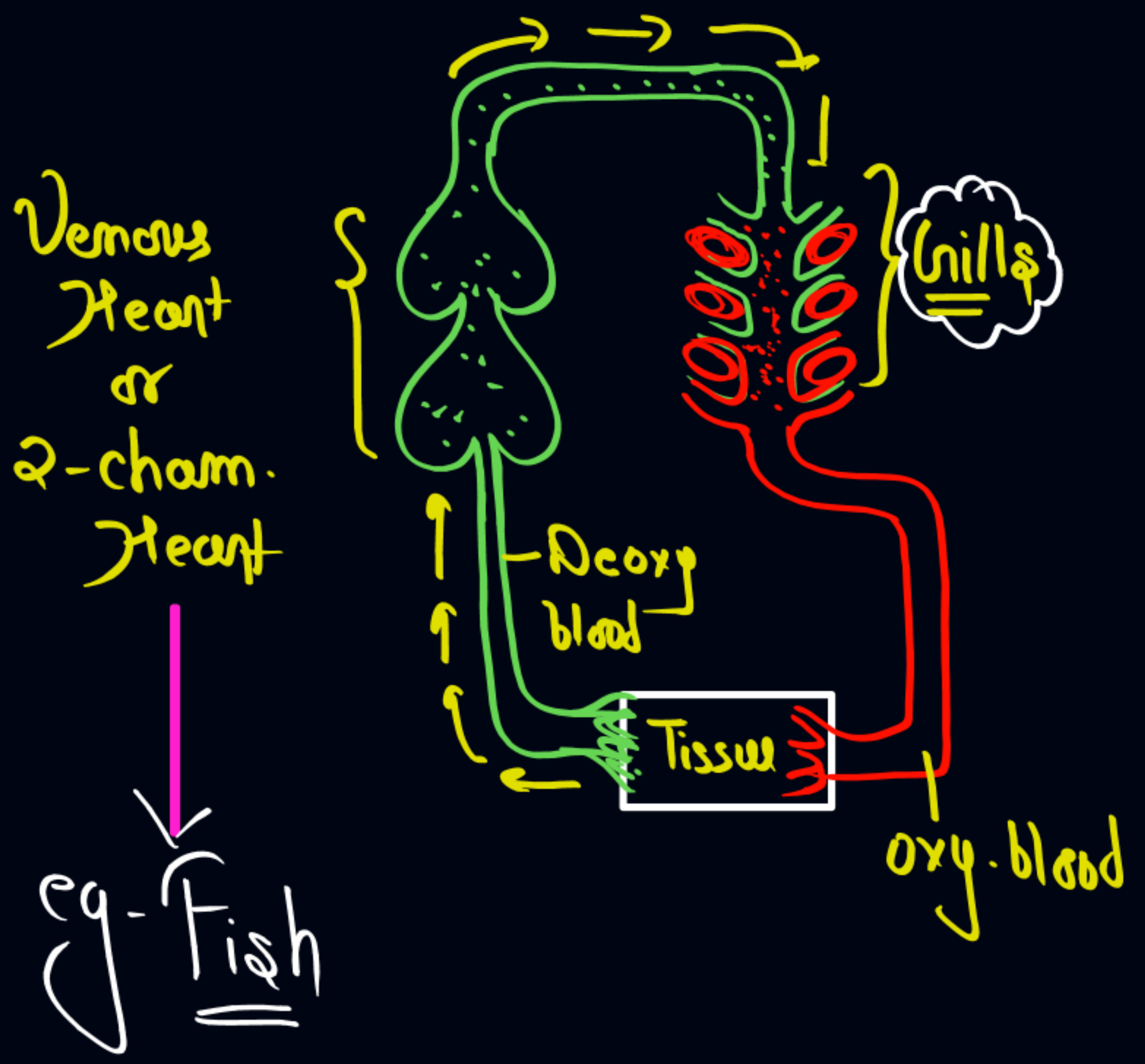
Blood Cavity
or
Haemocoel
or
Sinus



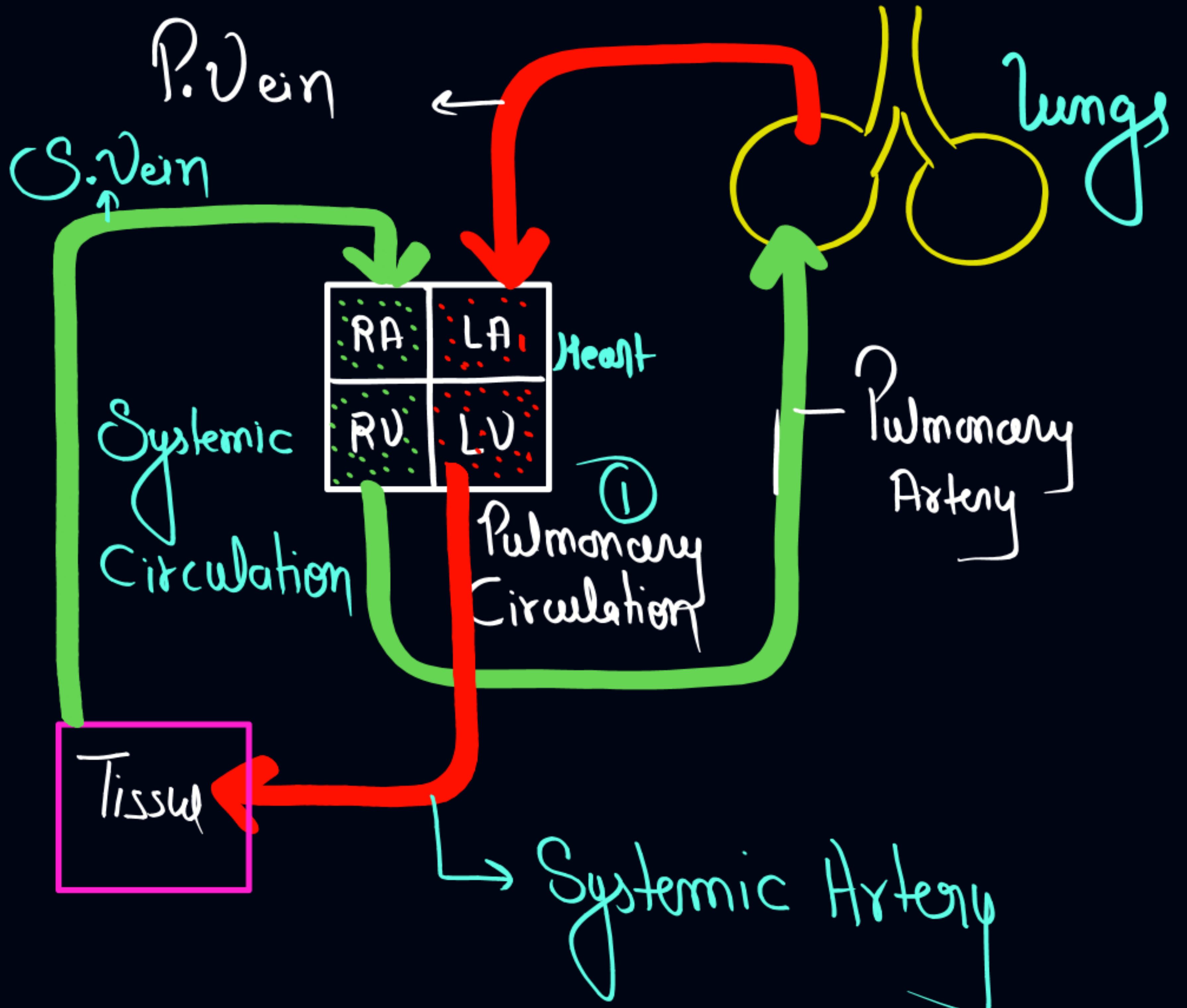
Arthropoda and Mollusca

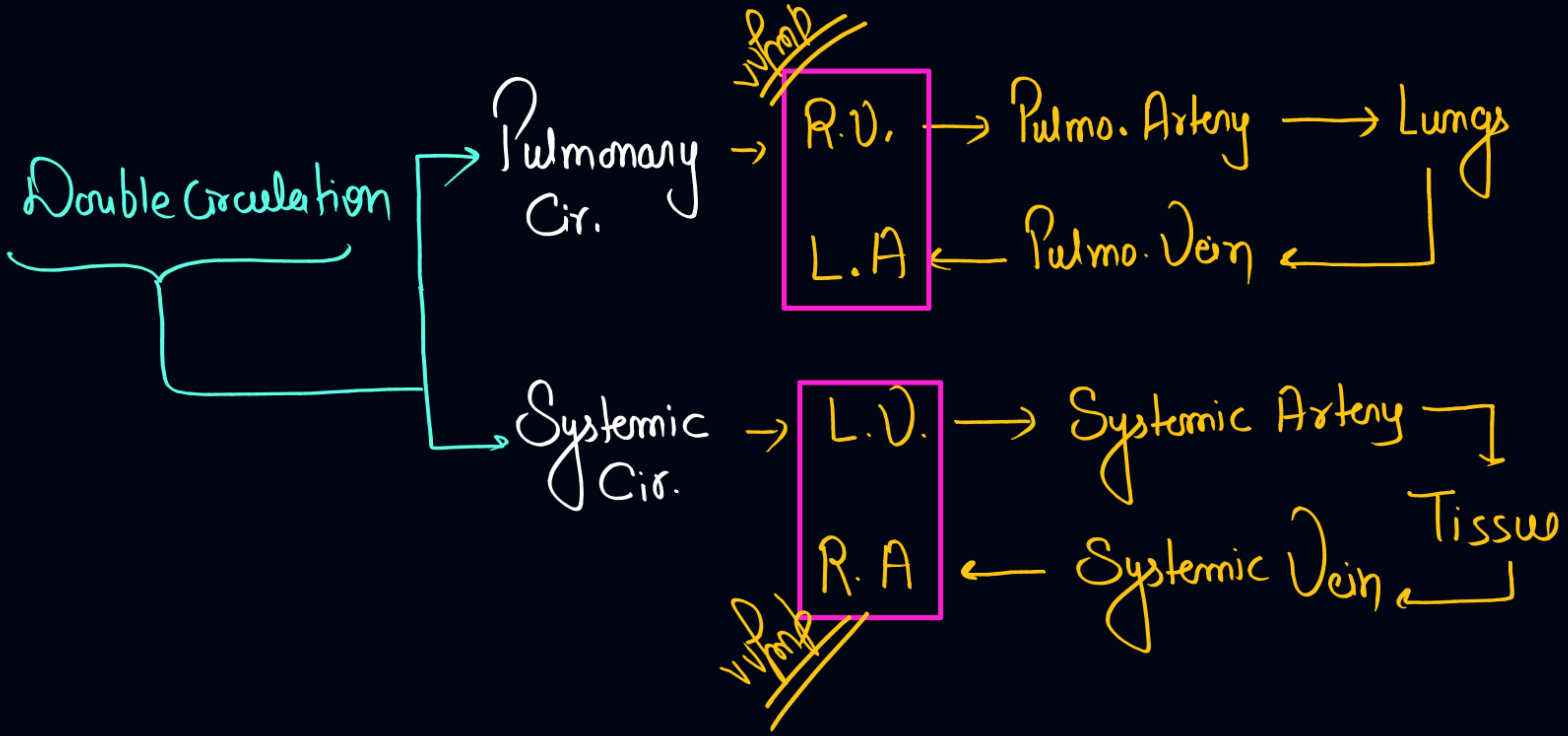
Annelida and Chordata

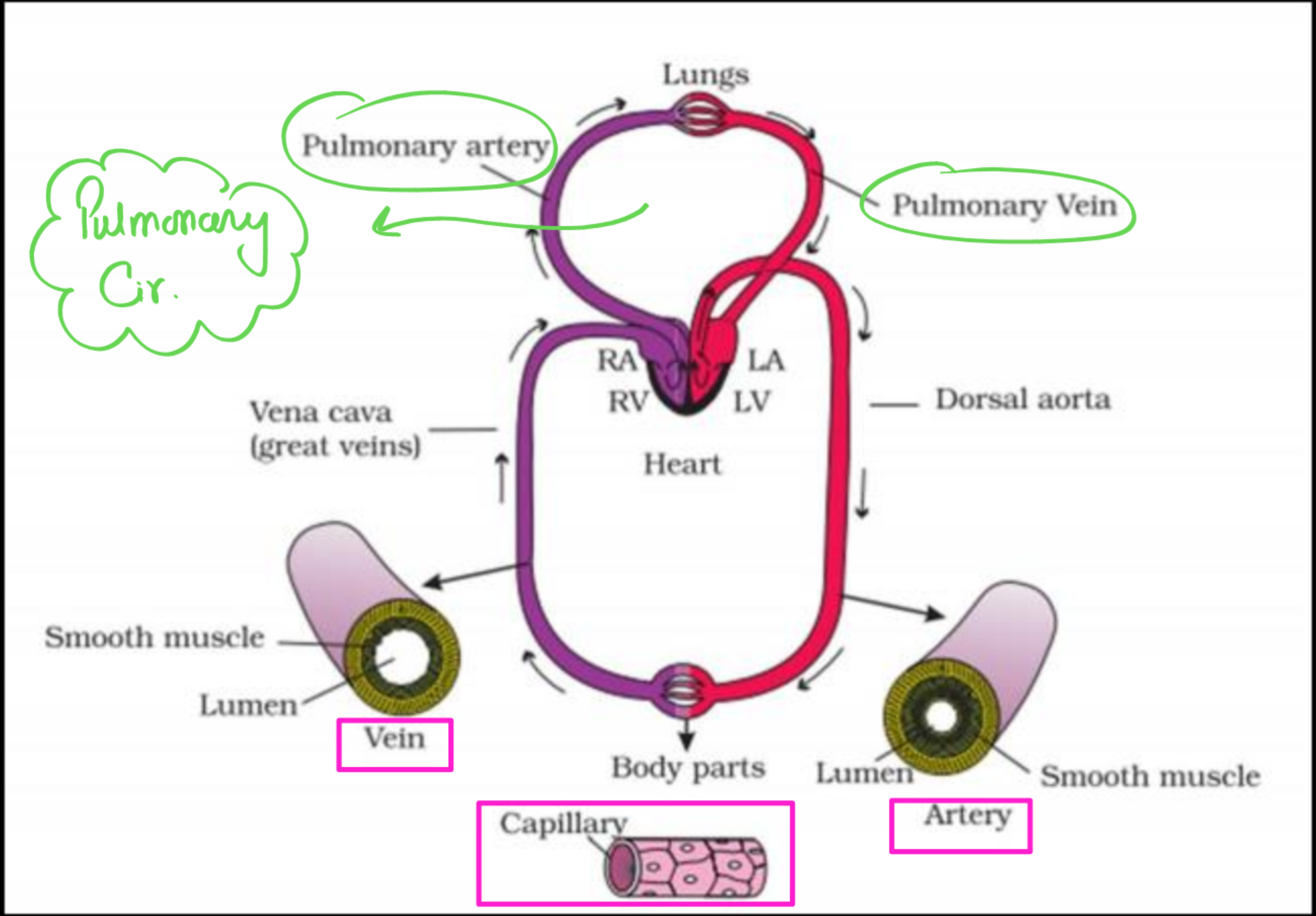
Single Circulation



Double circulation




Double circulation
Pulmonary Cir.
Systemic Cir.
vImp
R.V.
L.A
Pulmo. Artery
Lungs
Pulmo. Vein
L.V.
R.A
vImp
Systemic Artery
Tissue
Systemic Vein



Lungs
Pulmonary artery
Pulmonary Cir.
Pulmonary Vein
RA
LA
RV
LV
Dorsal aorta
Vena cava
(great veins)
Heart
Smooth muscle
Lumen
Vein
Body parts
Lumen
Smooth muscle
Artery
Capillary

H.W.

1.Lymph lacks

(1) WBCs (2) RBCs
(3) Tissue fluid (4) All of the above

2. Lymph contains _____ proteins than plasma

(1) Less (2) More
(3) Equal (4) None of the above

3. Blood group antigen is

(1) Found in Hb molecule (2) Found in Plasma protein
(3) Found on RBCs (4) None of the above

4. . Blood pumped by the heart passes through large vessels into open spaces or body cavities called

(1) Artery (2) Lymph node
(3) Vein (4) Sinuses

5. Circulatory system is absent in

(1)	Annelida	(2)	Arthropoda
(3)	Flatworm	(4)	Cephalopoda

6. The circulatory pattern in which blood pumped by the heart passes through large vessels into open spaces or body cavities is

(1) Open circulatory system
(2) Closed circulatory system
(3) Incomplete circulatory system
(4) Mixed circulatory system

7. Which ones have open circulatory system?

A.	Ascidia	B.	Cockroach
C.	Earthworm	D.	Prawn
E.	Silver Fish	F.	Snail
(1)	B, D, F	(2)	A, B, D, F
(3)	C, D, E	(4)	B, D, E, F

8. Closed circulatory system is present in

A.	Arthropoda	B.	Annelida
C.	Chordata	D.	Mollusca
(1)	B & C	(2)	A & B
(3)	B & D	(4)	A & D

8. The blood vascular system in hemichordata is

(1)	Open	(2)	Closed
(3)	Absent	(4)	Reduced

9. Single heart circuit occurs in

(1)	Fishes	(2)	Frogs
(3)	Reptiles	(4)	Man

10. How many chambers are found in avian heart?

(1)	Two	(2)	Three
(3)	Four	(4)	One

THANK YOU !!

MANTHAN NEET 2025

BODY FLUIDS AND CIRCULATION

LECTURE -5



ZOOLOGY

MD SIR

TODAY'S GOAL

- Structure of human Heart
- Conduction and Regulation of Heart beat
- Heart Sound & Cardiac Cycle
- Heart Disorders

1. Lymph lacks

(1) WBCs (2) RBCs

(3) Tissue fluid (4) All of the above

2. Lymph contains _____ proteins than plasma

(1) Less (2) More

(3) Equal (4) None of the above

3. Blood group antigen is

(1) Found in Hb molecule (2) Found in Plasma protein

(3) Found on RBCs (4) None of the above

4. . Blood pumped by the heart passes through large vessels into open spaces or body cavities called

(1) Artery (2) Lymph node

(3) Vein (4) Sinuses

5. Circulatory system is absent in

(1) Annelida (2) Arthropoda
(3) Flatworm (4) Cephalopoda

6. The circulatory pattern in which blood pumped by the heart passes through large vessels into open spaces or body cavities is

(1) Open circulatory system
(2) Closed circulatory system
(3) Incomplete circulatory system
(4) Mixed circulatory system

7. Which ones have open circulatory system?

A. Ascidia B. Cockroach
C. Earthworm D. Prawn
E. Silver Fish F. Snail

(1) B, D, F (2) A, B, D, F
(3) C, D, E (4) B, D, E, F

8. Closed circulatory system is present in

A. Arthropoda B. Annelida
C. Chordata D. Mollusca
(1) B & C (2) A & B
(3) B & D (4) A & D

8. The blood vascular system in hemichordata is

(1) Open (2) Closed
(3) Absent (4) Reduced

9. Single heart circuit occurs in

(1) Fishes (2) Frogs
(3) Reptiles (4) Man

10. How many chambers are found in avian heart?

(1) Two (2) Three
(3) Four (4) One

TYPES OF HEART IN ANIMALS

2-Chambered



- Single Circulation
- Venus Heart
- Pump- Deoxy. blood
- eg = tnt in Fish.

3-Chambered



- Incomplete Double Circulation
- Pump = Mixed blood
- eg → Amphibia

Incomplete 4-Chambered



- Incomplete Double Circulation
- Pump = Mixed blood

eg → Reptiles
Exept = Crocodite
[4-Chambered]

Complete 4-Chambered Heart

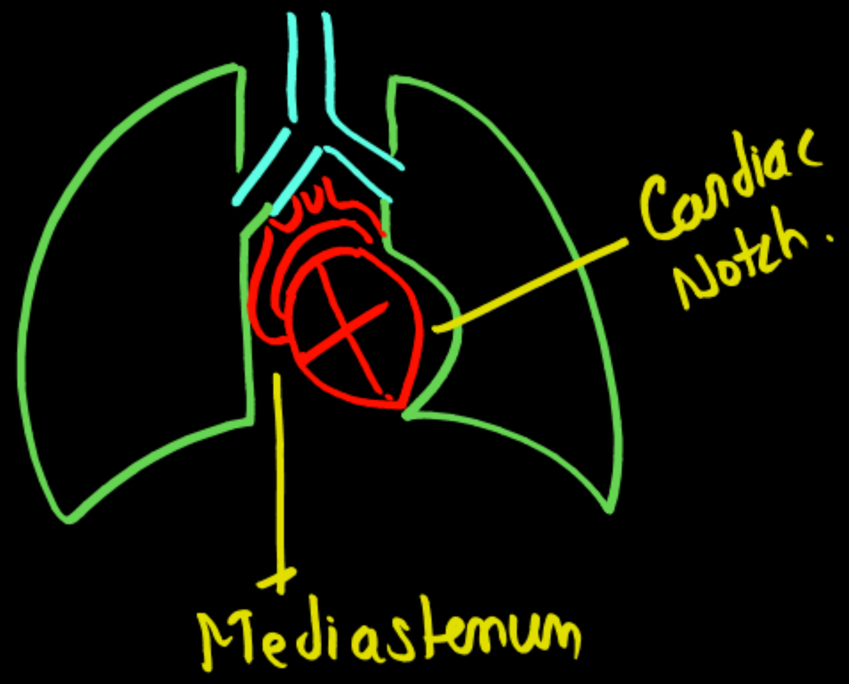


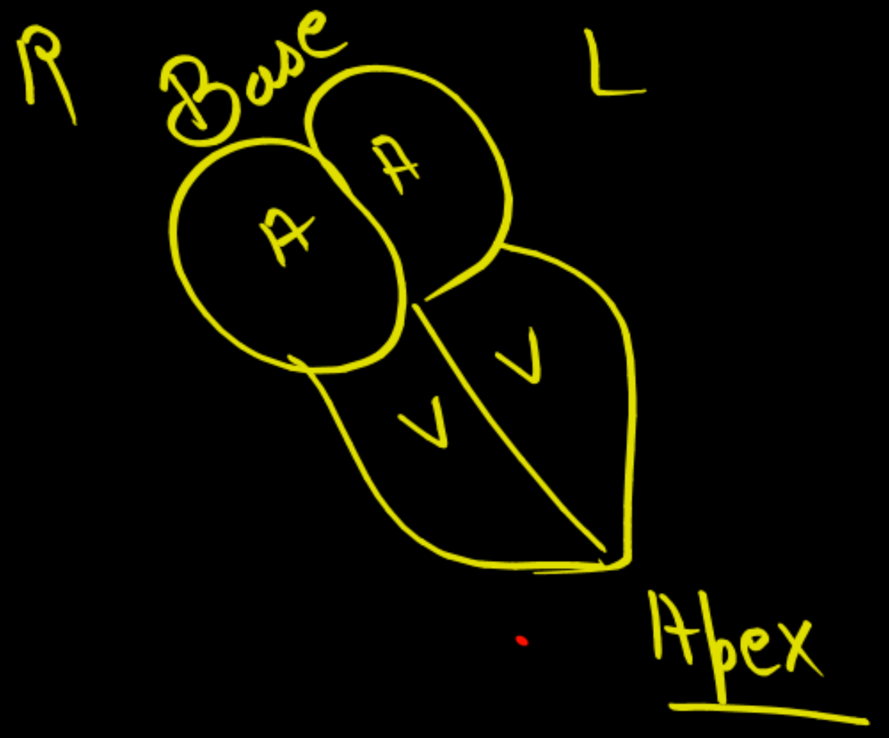
- Comple double Cir.
- Pump both
  - Deoxy blood
  - oxy. blood

eg → Birds
→ Mammals
→ Crocodile.

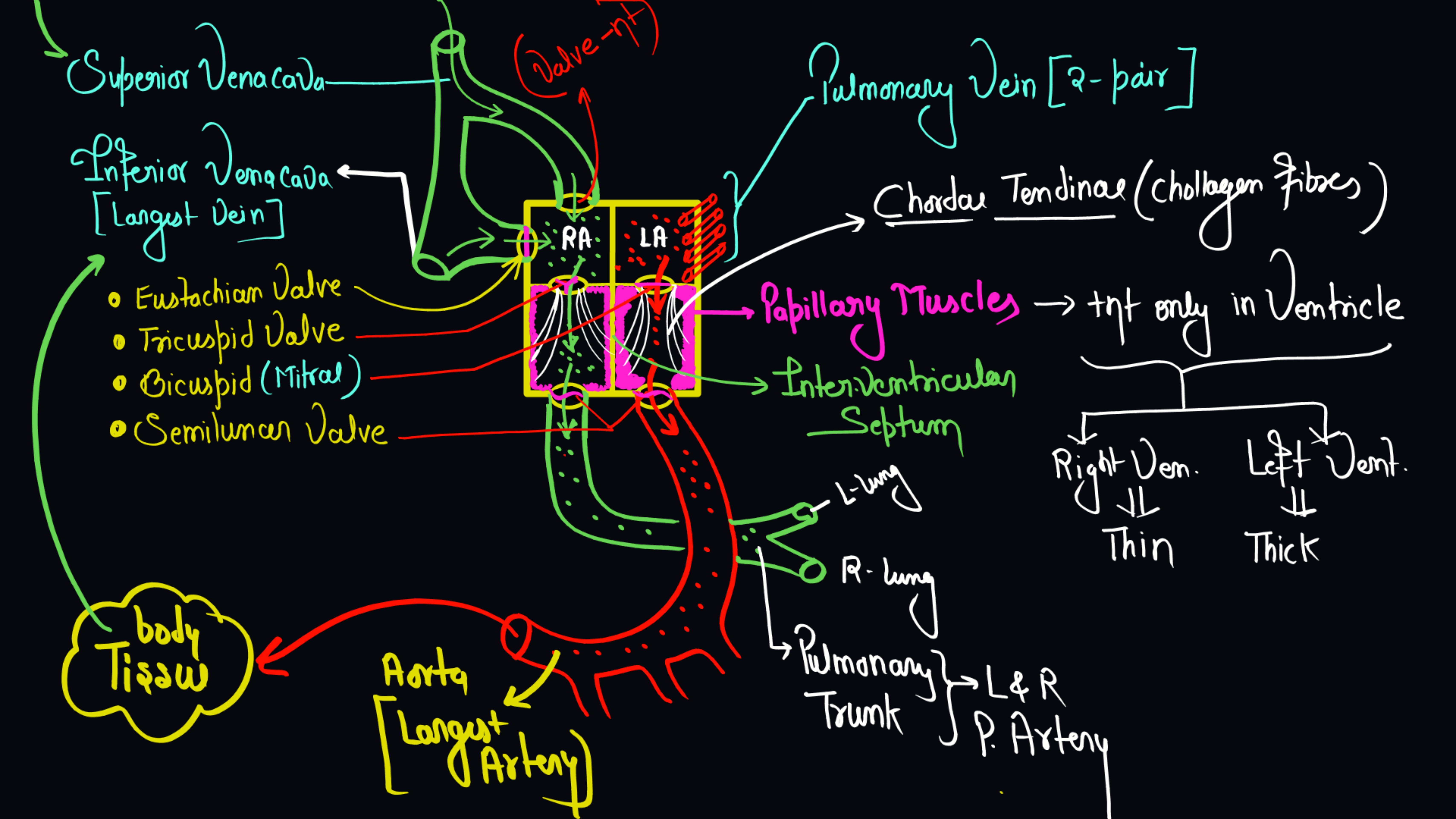
STRUCTURE OF HUMAN HEART

- Origin of Heart ⟶ Mesodermal
- Wt. of Heart ⟶ 250 - 300 gm
- Position of Heart → +nt b/w lungs, in mediastenum in Cardiac Notch, Pointed apex tilt towards - Left.

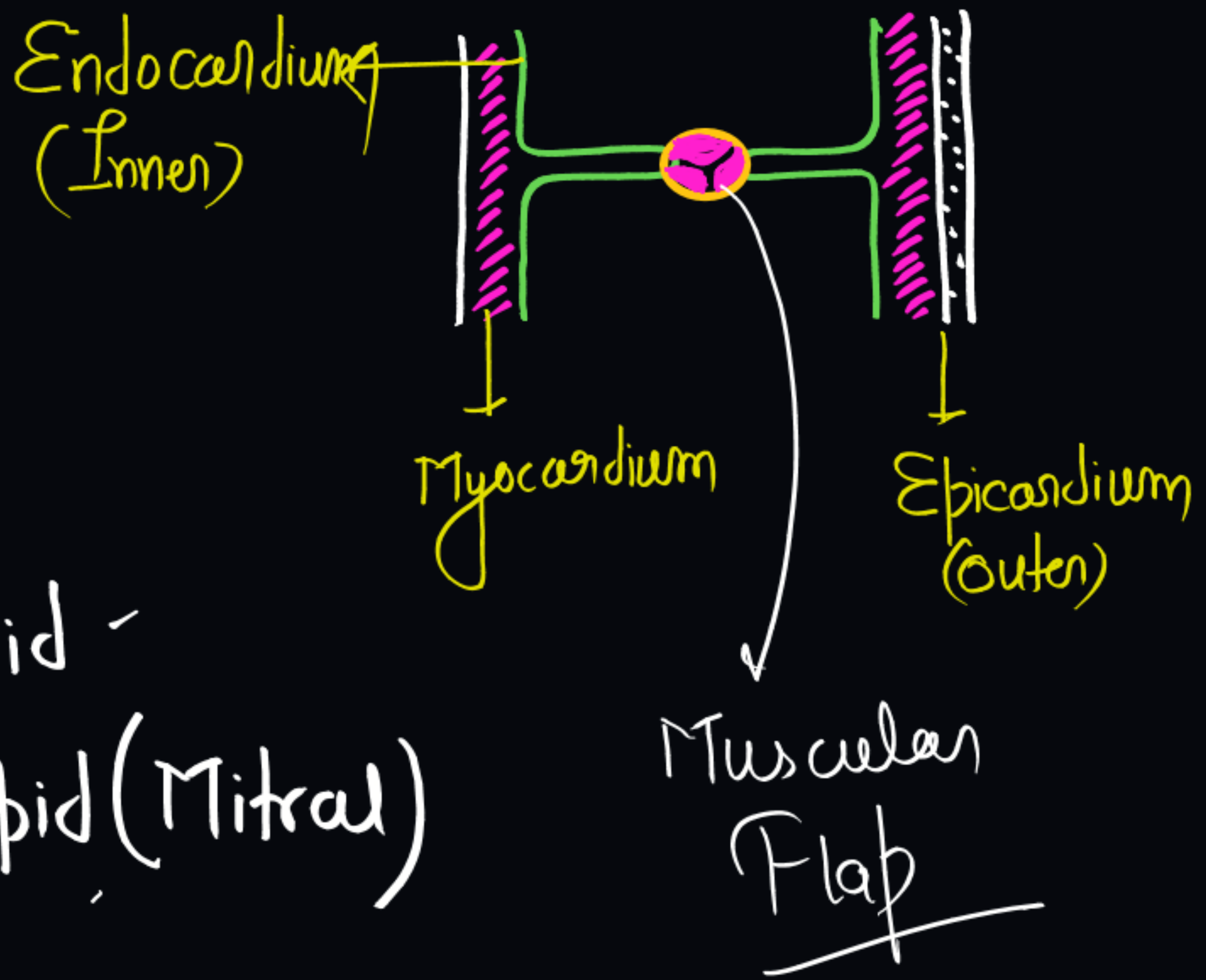




Note → Pointed apex tilt towards Right = Dextrocardia } Abnormal Position

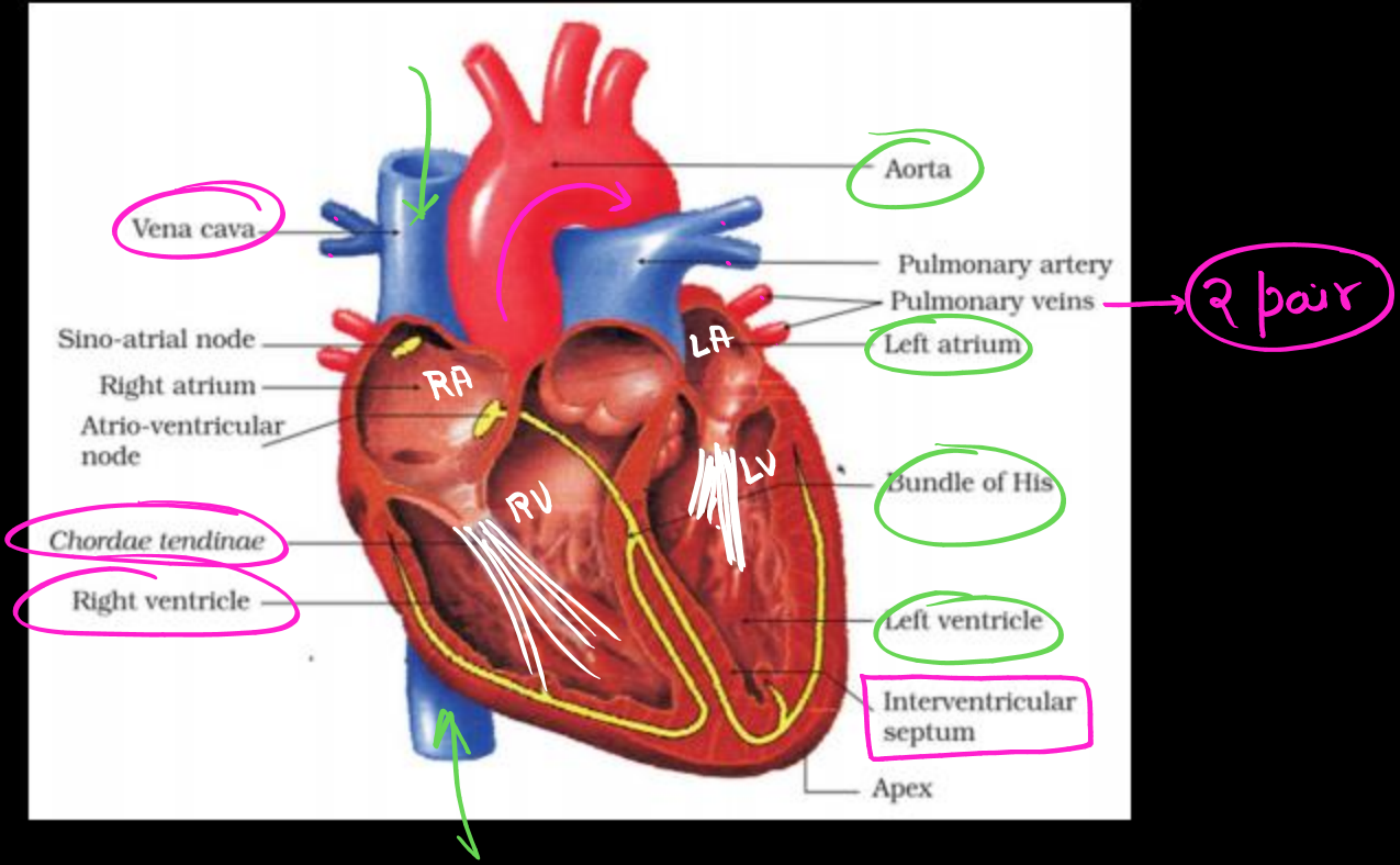

Superior Venacava
Inferior Venacava [Largest Vein]
Valve-nt
Pulmonary Vein [2-pair]
Chordae Tendinae (chollagen fibres)
RA
LA
Eustachian Valve
Tricuspid Valve
Bicuspid (Mitral)
Semilunar Valve
Papillary Muscles → tnt only in Ventricle
Right Ven. ⇓ Thin
Left Vent. ⇓ Thick
Interventricular Septum
L-lung
R-lung
Pulmonary Trunk → L & R P. Artery
body Tissue
Aorta [Largest Artery]

Valve of Heart → Double fold of Endocardium, with Muscular flap



- → Atrio-Ventricular Valve (A.V. Valve) or Cuspid Valve } → Tricuspid, Bicuspid (Mitral)
- → Ventriculo-arterial Valve } → Semilunar Valve





Vena cava
Aorta
Pulmonary artery
Pulmonary veins
2 pair
Sino-atrial node
Left atrium
Right atrium
Atrio-ventricular node
RA
LA
RV
LV
Bundle of His
Chordae tendinae
Right ventricle
Left ventricle
Interventricular septum
Apex

CONDUCTION OF HEART BEAT (Myogenic Heart)

Origin of Heart beat ⇒ Modified Cardiac Muscles

⇓

[Nodal Tissue]

→ Show = Autorhythmicity

Types of Nodal Tissue →

1) → S.A. Node (Pace Maker)
2) ⇒ A.V. Node (Pace Setter)
3) ⇒ Bundle of His (Bundle of Purkinje fibres)
4) ⇒ Purkinji fibres.

1) - S.A. Node

* Position = upper Right Corner of R- Atrium
* Potential = 70-75 beat / minute

2) - A.V. Node =

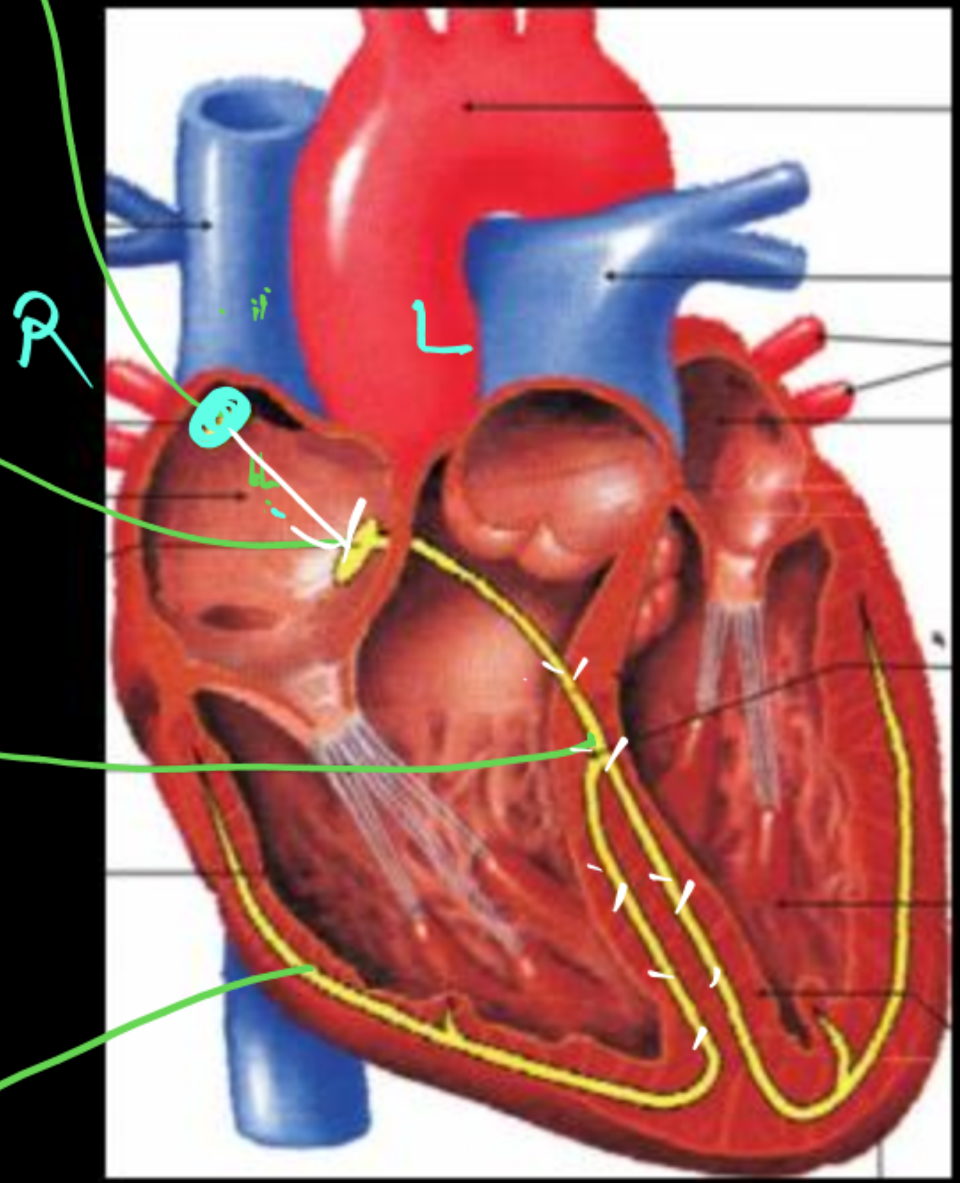
* Position = Lower Left Corner of R- Atrium
* Potential = 60-65 impulse or beat / minute

3) - Bundle of Hiss

* Position = Inter Ventricular Septum
* Potential = 40-45 impulse / min.

4) → Purkinje fibres

* Position = Wall of Ventricle.
* Potential = 20-25 impulse / min.



Note →

* Longest Nodal Tissue ⇒ S.A. Node
  - ↓ Responsible for Rhythmicity of Heart.

* If S.A. Node = Non functional
  - ↓ Heart become = Arrythmic
  - ⇓ Use = Artificial Pacemaker for Rhythmicity of Heart

Tatva

H.W.

Volume-5 →

Page- 80 – 86 = 75 Q

THANK YOU !!

MANTHAN NEET 2025

SANKALP NEET VEDANTU

BODY FLUIDS AND CIRCULATION

LECTURE -6

ZOOLOGY

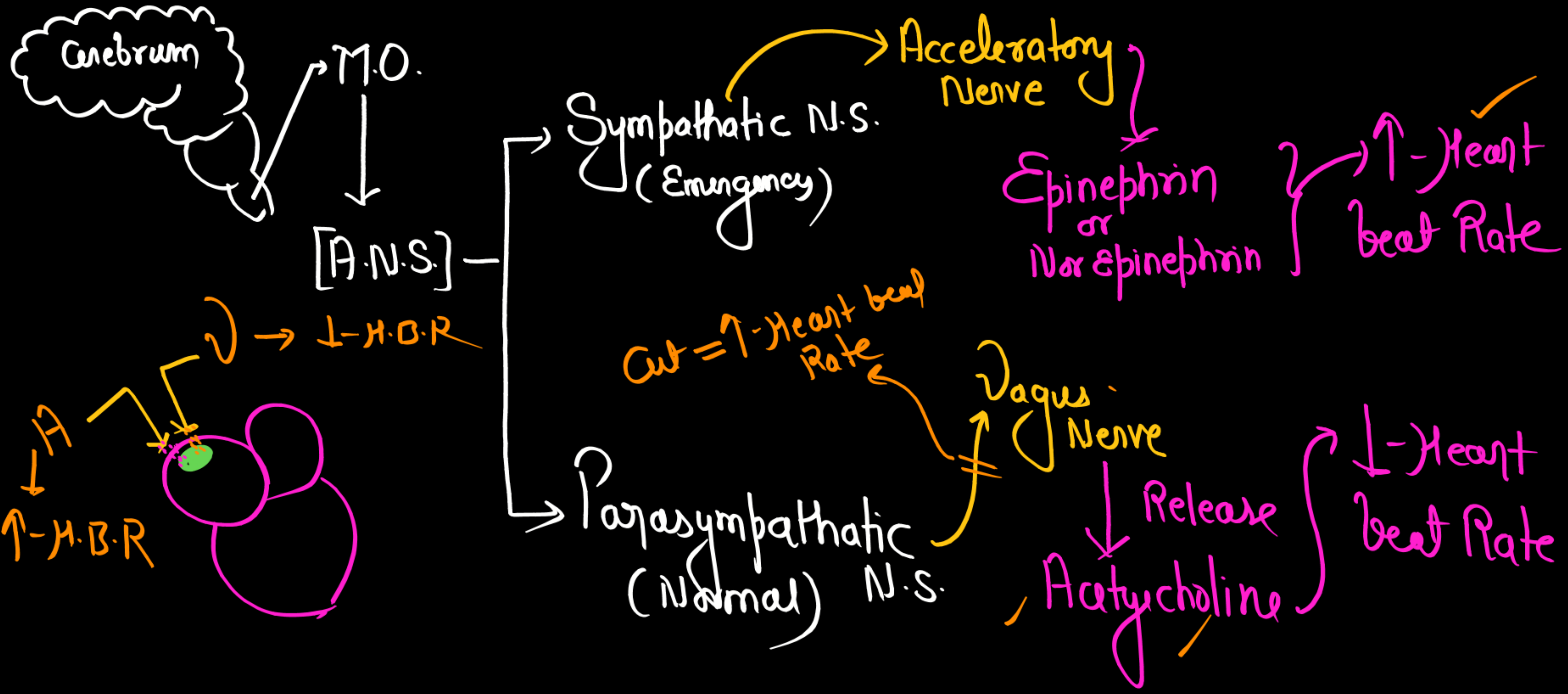


MD SIR

TODAY'S GOAL

- Regulation of Heart beat
- Heart Sound & Cardiac Cycle
- Heart Disorders

REGULATION OF CARDIAC ACTIVITY



Hormonal Regulation →

Thyroid gland → Thyroxin → ↑ B.M.R → ↑ Heart beat Rate



Adrenal Gland (Medula) → Epinephrin (Adrenalin) & Norepinephrin (Noradrenalin) → ↑ Heart beat Rate.

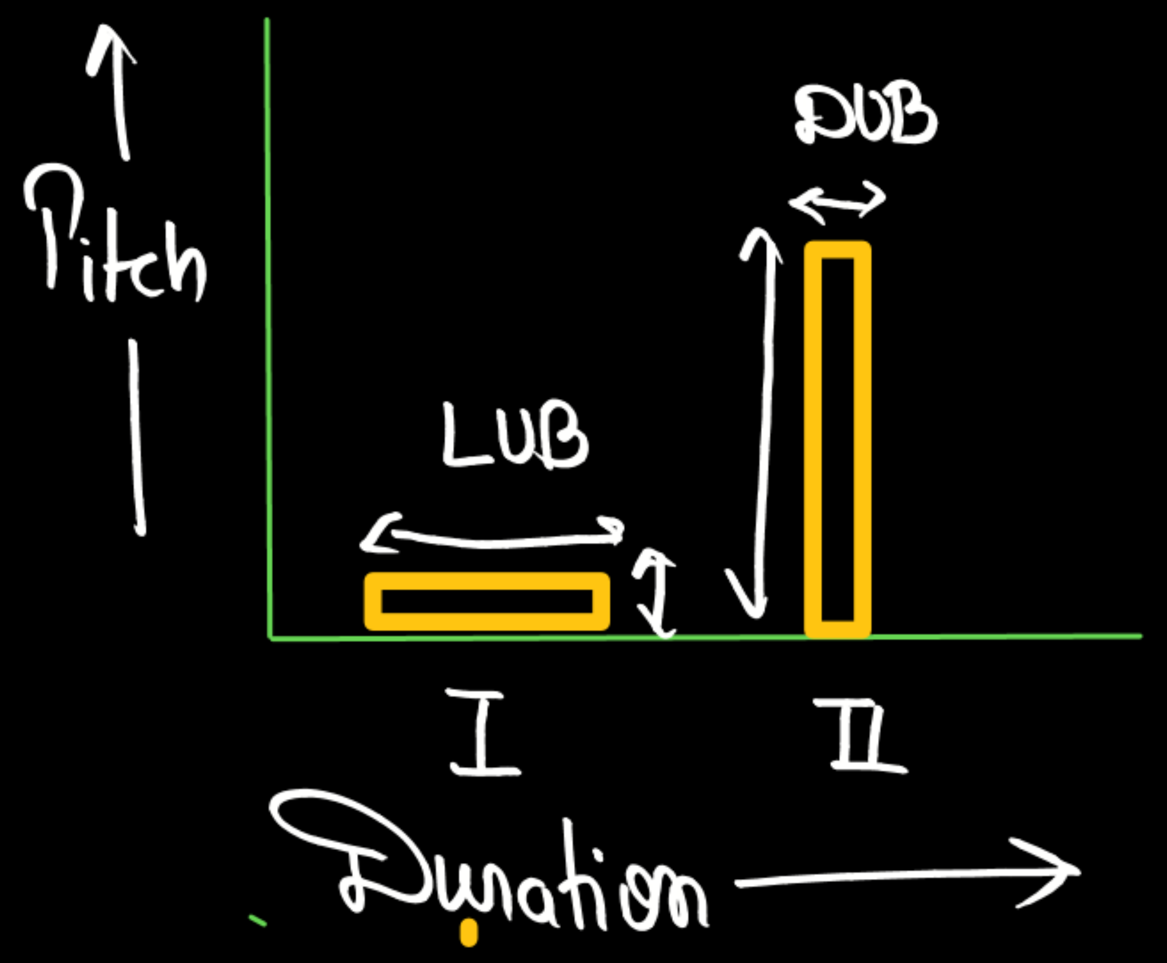
↓

(Emergency gland)

Emergency Hor.

HEART SOUND

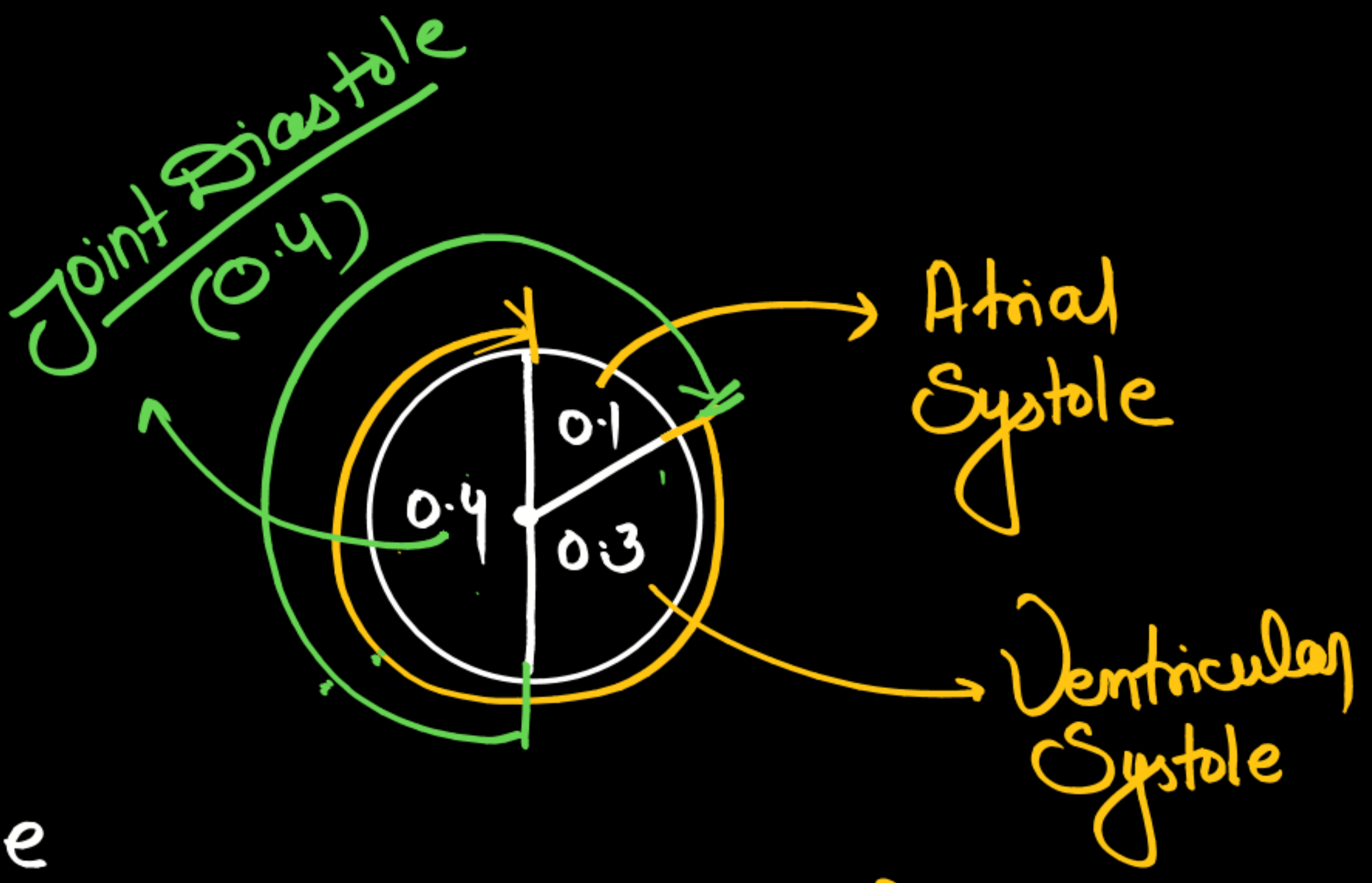
- During each cardiac cycle two prominent sounds are produced which can be easily heard through a stethoscope.
- These sounds are of clinical diagnostic significance.



LUB [Ist-Sound]	DUB [IInd-Sound]
• Ventricular Systolic Sound	• Ventricular Diastolic Sound
• Due to Clossing of A-V Valve	Due to clossing of Semiluman Valve
• Duration = ↑	= ↓
• Pitch = ↓	= ↑

CARDIAC CYCLE

- It is a Complete Contraction and Relaxation of Single Cardiac Muscle or Atria or Ventricle
- Duration of Single Caniac Cycle = 0.8 Sec.
- Duration of Single Heart beat = 0.8 Sec.



	Atria	Ventricle
Systole =	0.1	0.3
Diastole =	0.7	0.5
	0.8	0.8

At the end of joint diastole ⟹ 70% (2/3) Ventricle fill by blood Passivelly in 0.4 Sec

Atrial Systole Start

At the end of Atrial Systole Remaining = 30% (1/3) Ventricle fill by blood = Activelly (0.1 Sec)



Joint Diastole

Ventricle Systole Start

Ist Heart Sound = LUB

Due to clossing of A.V. Valve

Duration b/w –

- I & II – Sound = 0.3 Sec
- II & I – Sound = 0.5 Sec

Ventricular Diastole

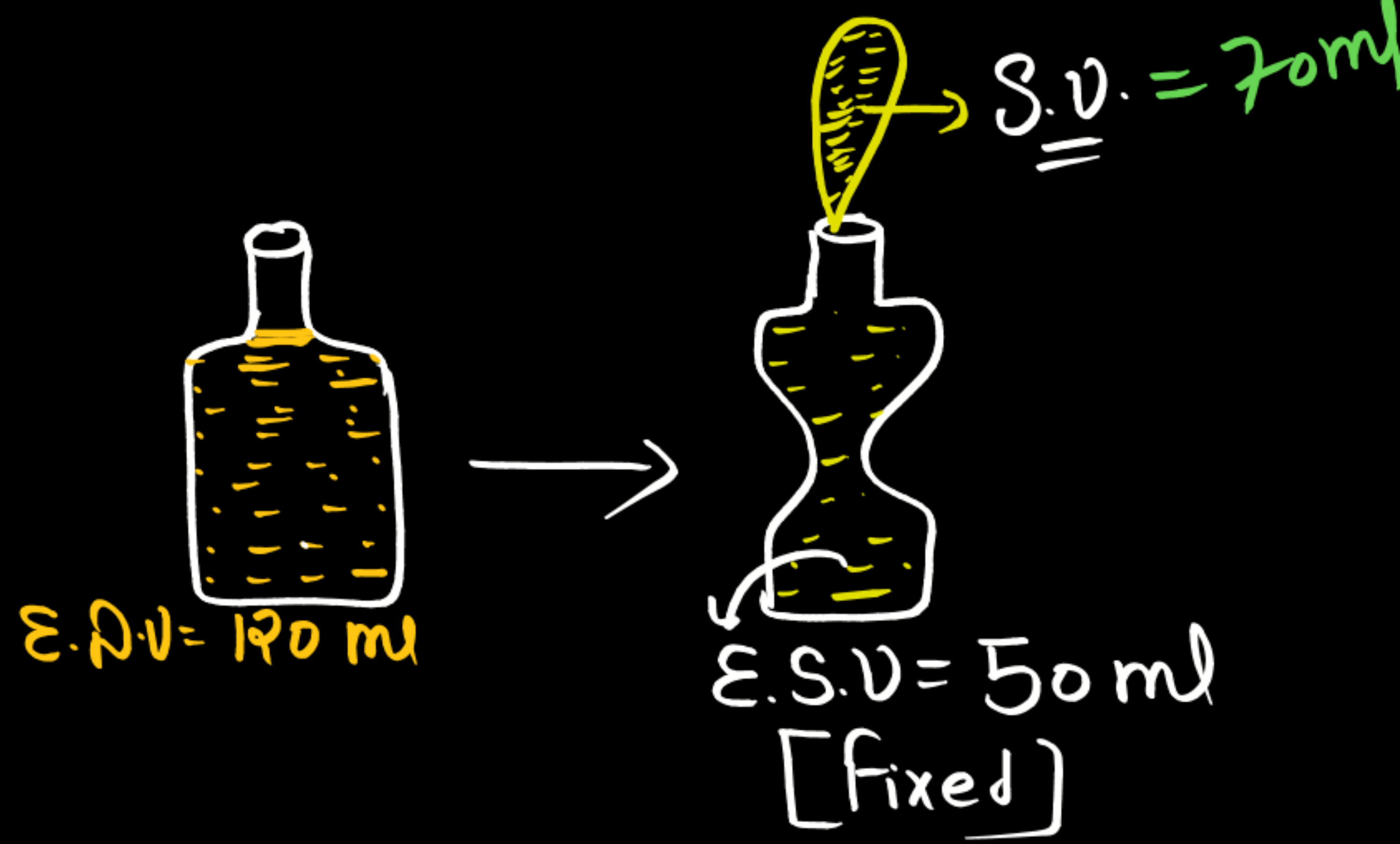
[IInd Heart Sound = Dub]

Due to clossing of Semilunar Valve.

End Diastolic Volume (EDV) = 120ml

Volu. of blood fill in each Ventricle at the end of their Diastole

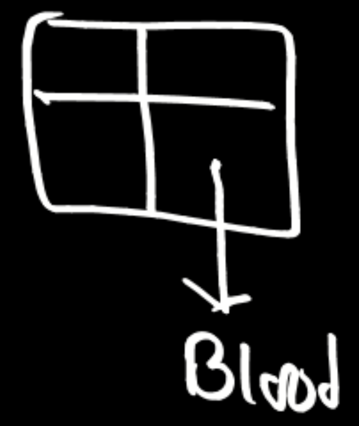
[EDV ∝ Size of Ventricle]



End Systolic Volume (ESV) =

Volu. of blood which remains in each Ventricle - at the end of their Systole

$$ESV = EDV - SV$$
$$= 120 - 70$$
$$= 50\ ml$$



STROKE VOLUME (SV) -

Volu. of blood which pump by Each Ventricle during Single Systole

$$SV = EDV - ESV$$
$$= 120 - 50$$
$$= 70\ ml$$

$$EDV \propto SV$$

vvImp

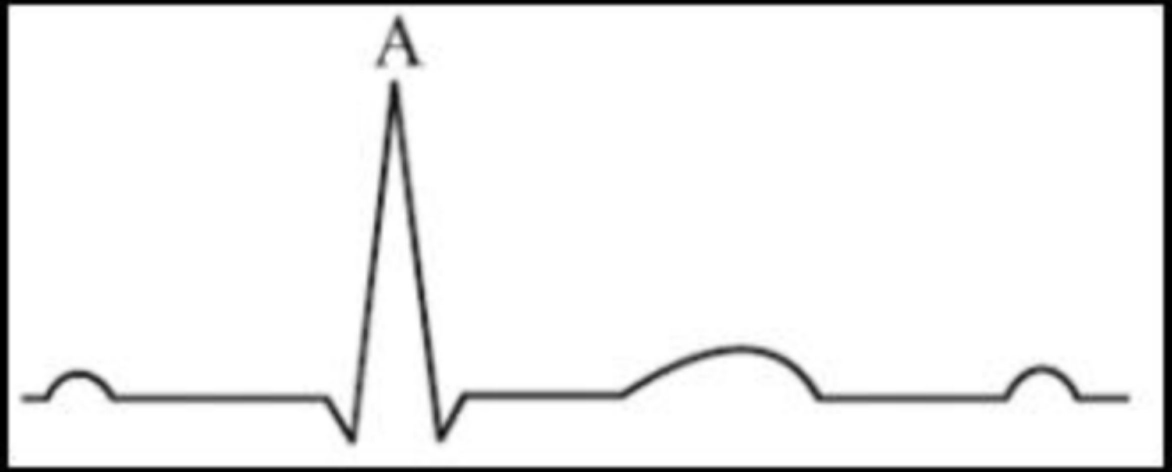
CARDIAC OUTPUT (CO) -

Volu. of blood which pump by - Each Ventricle / minute

$$CO = S.V \times H.B.R$$
$$= 70 \times 72$$
$$= 5000\ ml/minute$$

1. In this figure, peak point (A) is represented by letter

H.W



(1) P (2) Q

(3) R (4) S

2. Which of the following statement is correct?

(1) Deoxygenated blood is poured into right atrium of heart

(2) The excretory units of flatworms are flame cells

(3) Human kidney has about one million nephridia

(4) Both (1) & (2)

3. During ventricular systole
(1) Oxygenated blood is pumped into the pulmonary artery and deoxygenated blood is pumped into the artery
(2) Oxygenated blood is pumped into the aorta and deoxygenated blood is pumped into the pulmonary vein
(3) Oxygenated blood is pumped into the pulmonary vein and deoxygenated blood is pumped into the pulmonary artery
(4) Oxygenated blood is pumped into the aorta and deoxygenated blood is pumped into the pulmonary artery

4. What happens when the pacemaker is non-functional?
(1) Only the auricles will contract rhythmically
(2) The cardiac muscles do not contract in a coordinated manner rhythmically
(3) Only ventricles will contract rhythmically
(4) Auricles and ventricles contract simultaneously

5. Which of the following correctly explains a phase/event in cardiac cycle in a standard electrocardiogram?
(1) QRS complex indicates atrial contraction
(2) QRS complex indicates ventricular contraction
(3) Time between S and T represents atrial systole
(4) P-wave indicates beginning of ventricular contraction

6. An adult human with average health has systolic and diastolic pressures as
(1) 120 mm Hg and 80 mm Hg
(2) 50 mm Hg and 80 mm Hg
(3) 80 mm Hg and 80 mm Hg
(4) 70 mm Hg and 120 mm Hg

7. To obtain a standard ECG, a patient is connected to the machine with three electrodes

(1) One to each wrist and to the left ankle
(2) One to each ankle and to the left wrist
(3) One to each wrist and to the left chest region
(4) One to each ankle and to the left chest region

8. Bundle of His a network of

(1) Muscle fibres distributed throughout the heart walls
(2) Muscle fibres found in the ventricle wall
(3) Nerve fibres distributed in ventricles
(4) Nerve fibres found throughout the heart

9. What would be the heart rate of a person if the cardiac output is 5 L, blood volume in the ventricles at the end of the diastole is 100 mL and at the end of ventricular systole is 50 mL?

(1) 50 beats per minute

(2) 75 beats per minute

(3) 100 beats per minute

(4) 125 beats per minute

HBR = ?

CO = 5000 ml

EDV = 100 ml

ESV = 50 ml

10. Cardiac output is

(1) Volume of the blood pumped out by each ventricle per minute

(2) Volume of the blood contained in the entire heart

(3) Volume of the oxygenated blood pumped by heart

(4)Volume of the deoxygenated blood pumped by heart

THANK YOU !!

MANTHAN NEET 2025

BODY FLUIDS AND CIRCULATION

LECTURE -7

ZOOLOGY



MD SIR

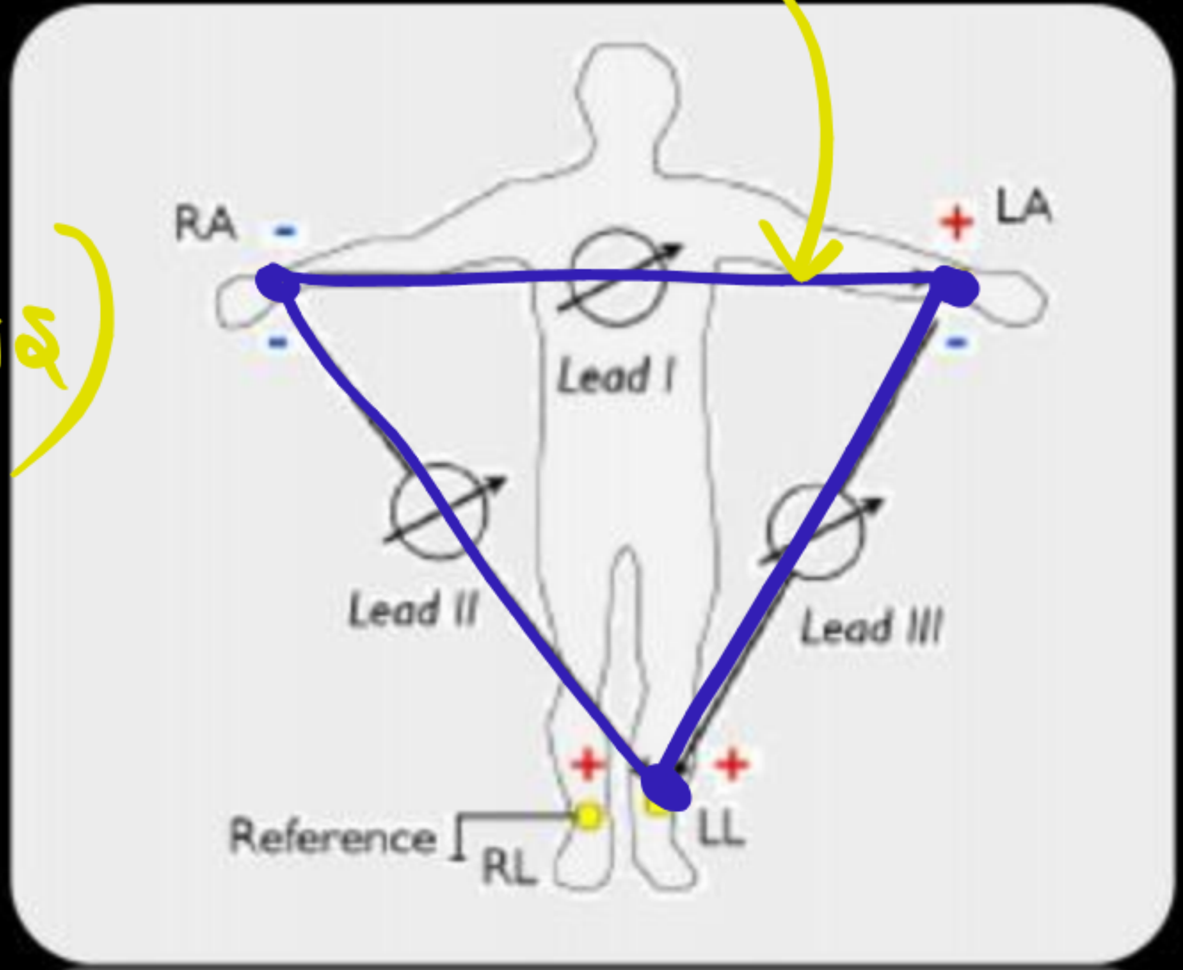
SANKALP NEET VEDANTU

TODAY'S GOAL

- ECG
- Heart Disorders

Electrocardiograph (ECG)

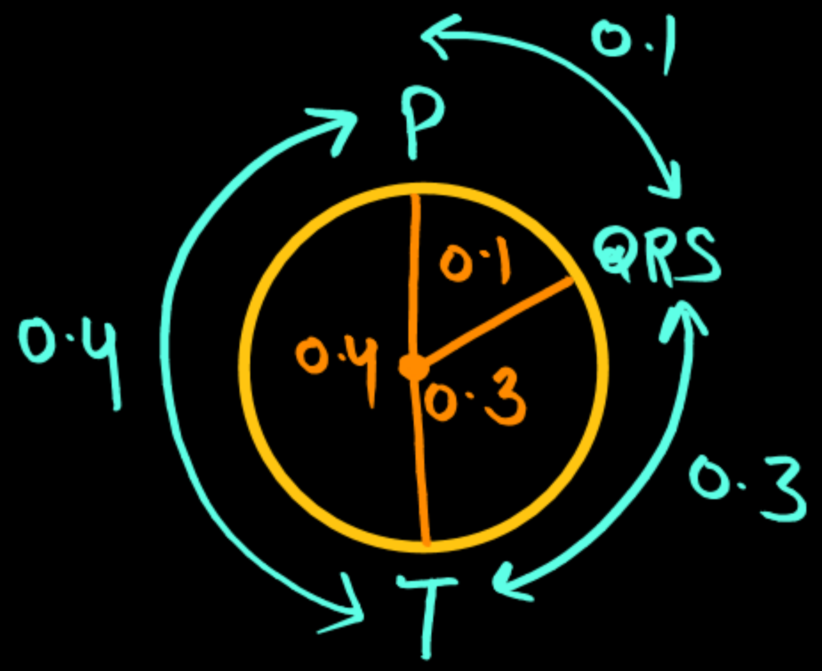
- ECG is a graphical representation of the electrical activity of the heart during a cardiac cycle.
- To obtain a standard ECG a patient is connected to the machine (Electrocardiograph) with three electrical leads (one to each wrist and to the left ankle) that continuously monitor the heart activity.

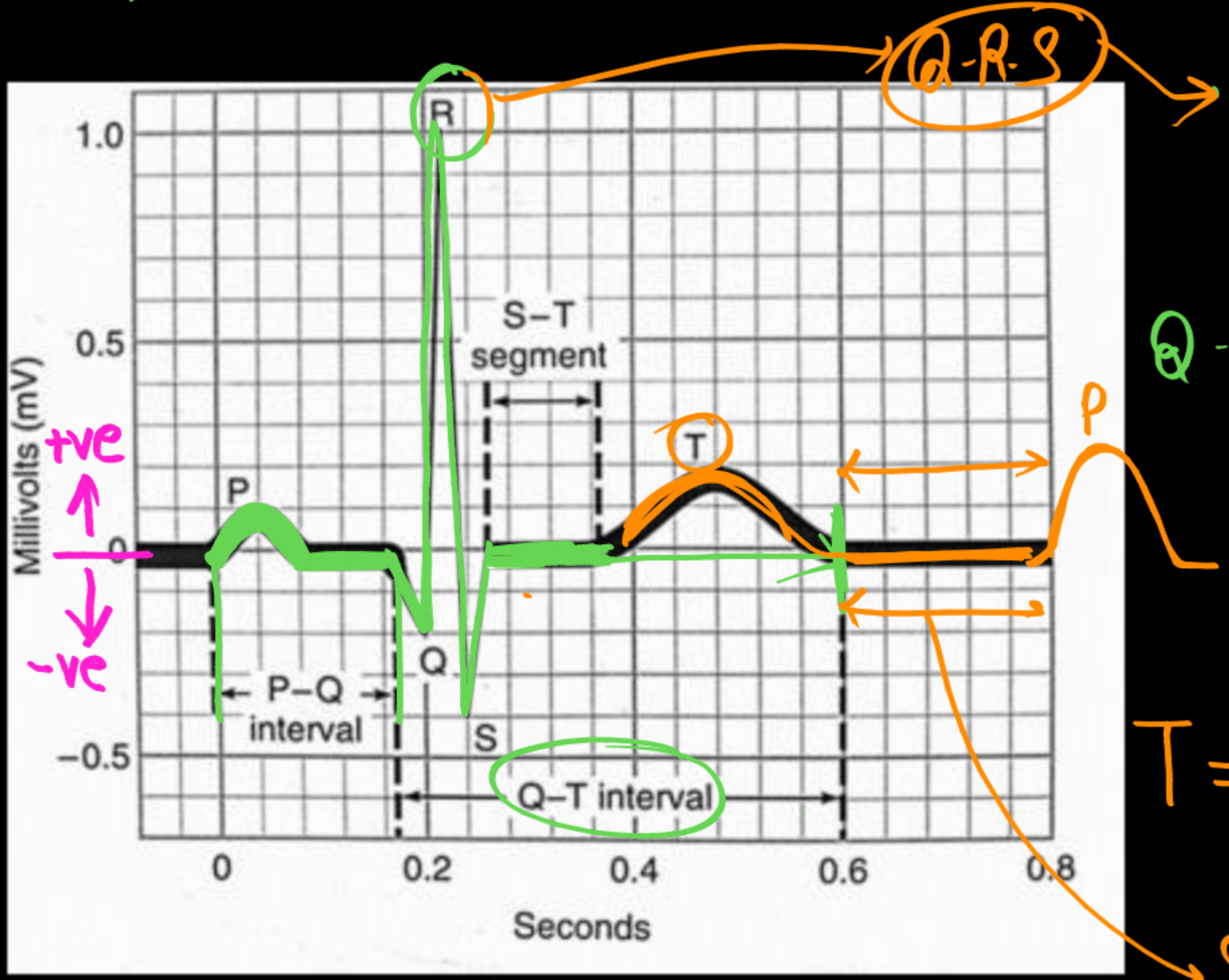


P = Depolarization in Atria

P–Q = Action poten. + Duration of Contraction in both atria







Q-R-S → Depolarisation in Ventricle (A. potential)

Q - T = A. Potential in Ventricle + Contraction in both Ventricle

T = Repolarisation in Ventricles

T-P = Duration of Ventricular Diastole

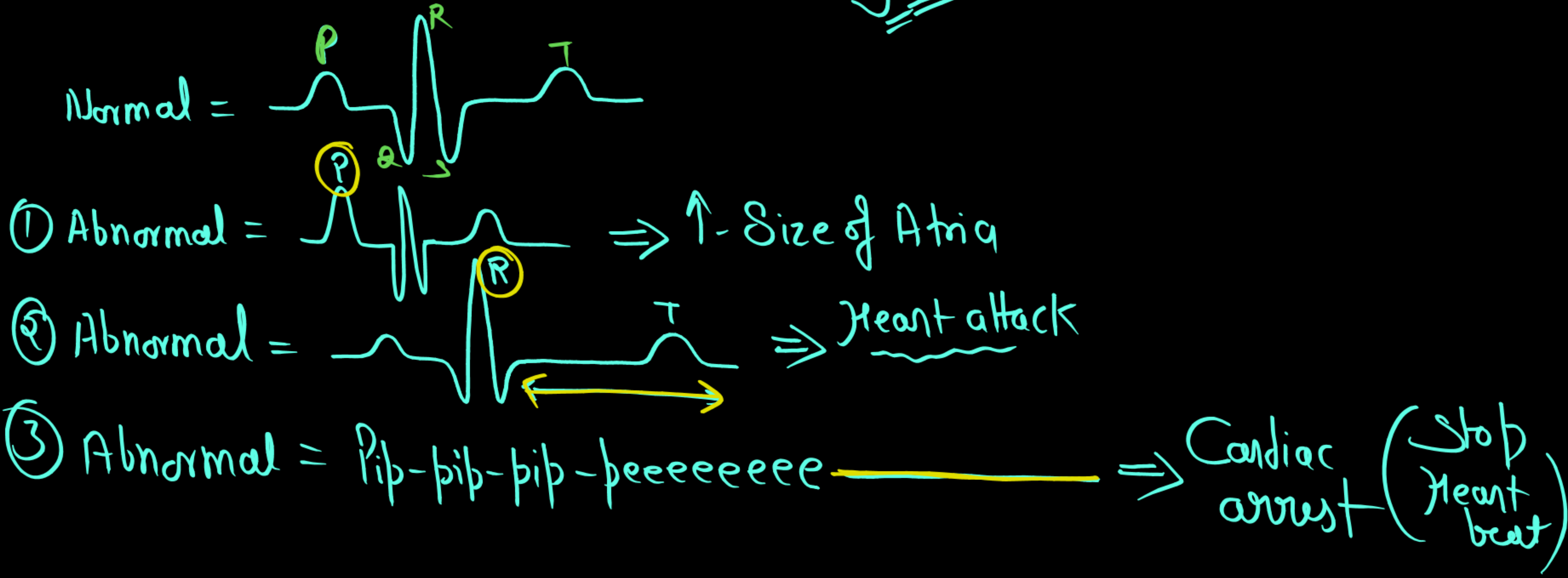
1. The P-wave represents the electrical excitation (or depolarisation) of the atria, which leads to the contraction of both the atria.
2. The QRS complex represents the depolarisation of the ventricles, which initiates the ventricular contraction. The contraction starts shortly after Q and marks the beginning of the systole.
3. The T-wave represents the return of the ventricles from excited to normal state (repolarisation). The end of the T-wave marks the end of systole

- Obviously, by counting the number of QRS complexes that occur in a given time period, one can determine the heart beat rate of an individual.



H.B.R = No. of QRS/minute

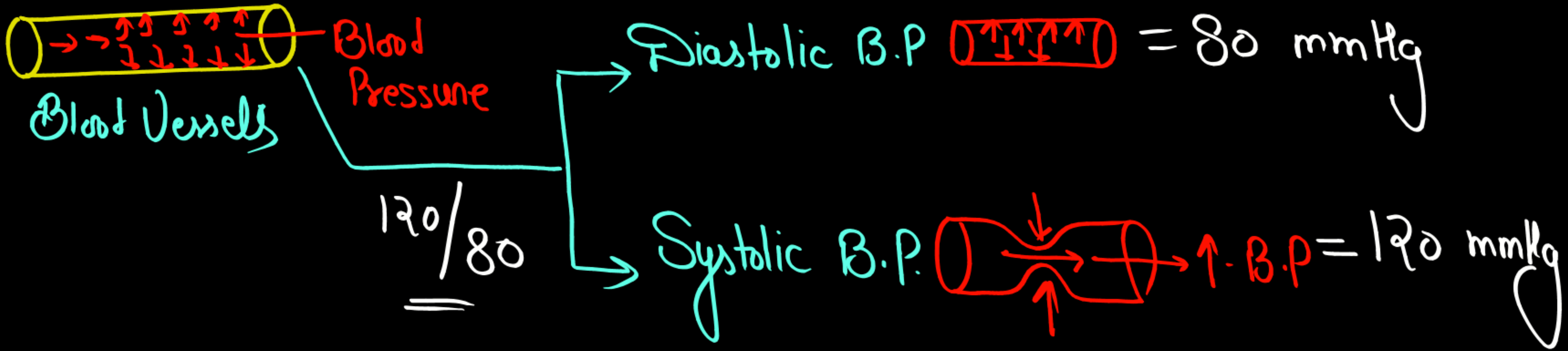
- Since the ECGs obtained from different individuals have roughly the same shape for a given lead configuration, any deviation from this shape indicates a possible abnormality or disease.
- Hence, it is of a great clinical significance.



DISORDERS OF CIRCULATORY SYSTEM

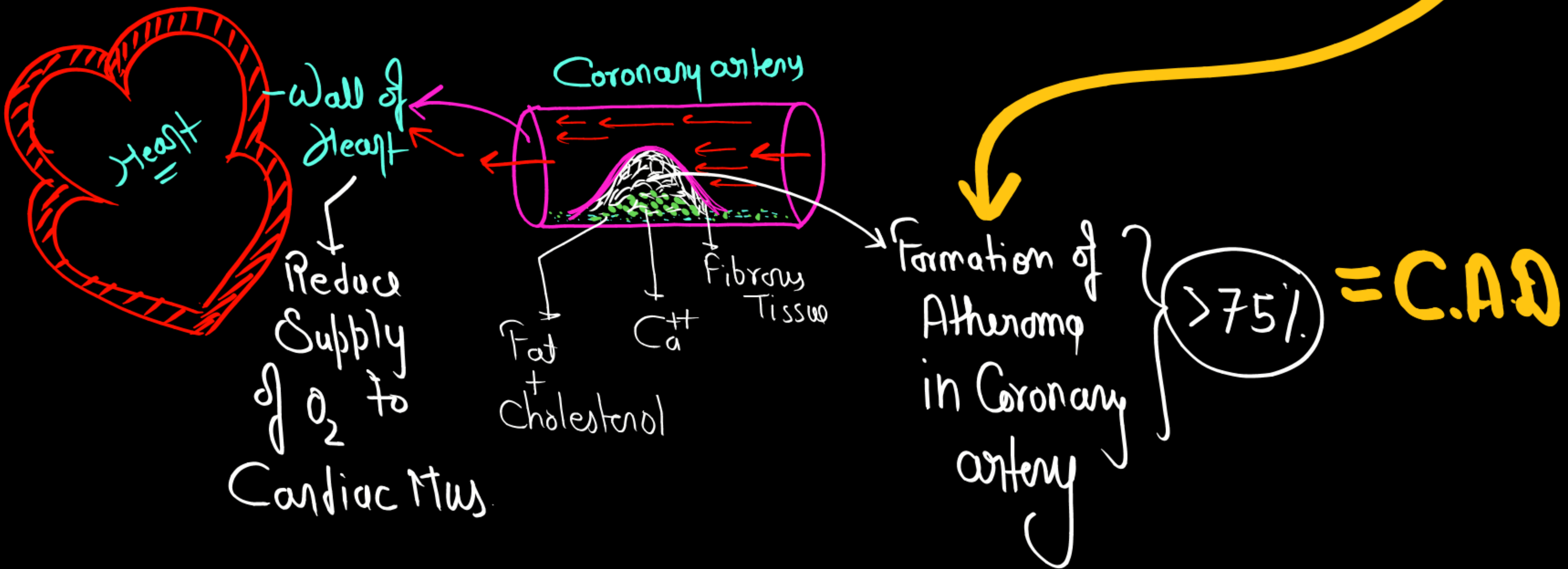
(1) High Blood Pressure (Hypertension):

- Hypertension is the term for blood pressure that is higher than normal (120/80). If repeated checks of blood pressure of an individual is 140/90 (140 over 90) higher, it shows hypertension.
- High blood pressure leads to heart diseases and also affects vital organs like brain and kidney.



(2) Coronary Artery Disease (CAD):

- Coronary Artery Disease, often referred to as atherosclerosis, affects the vessels that supply blood to the heart muscle.
- It is caused by deposits of calcium, fat, cholesterol and fibrous tissues, which makes the lumen of arteries narrower. blood flow



C.A.D → ↓ Supp. of O_2 to Cardiac Mus.

→ Myocardial Ischaemia

↓

Heart Failure

↓

Angina

↓

Heart Attack

↓

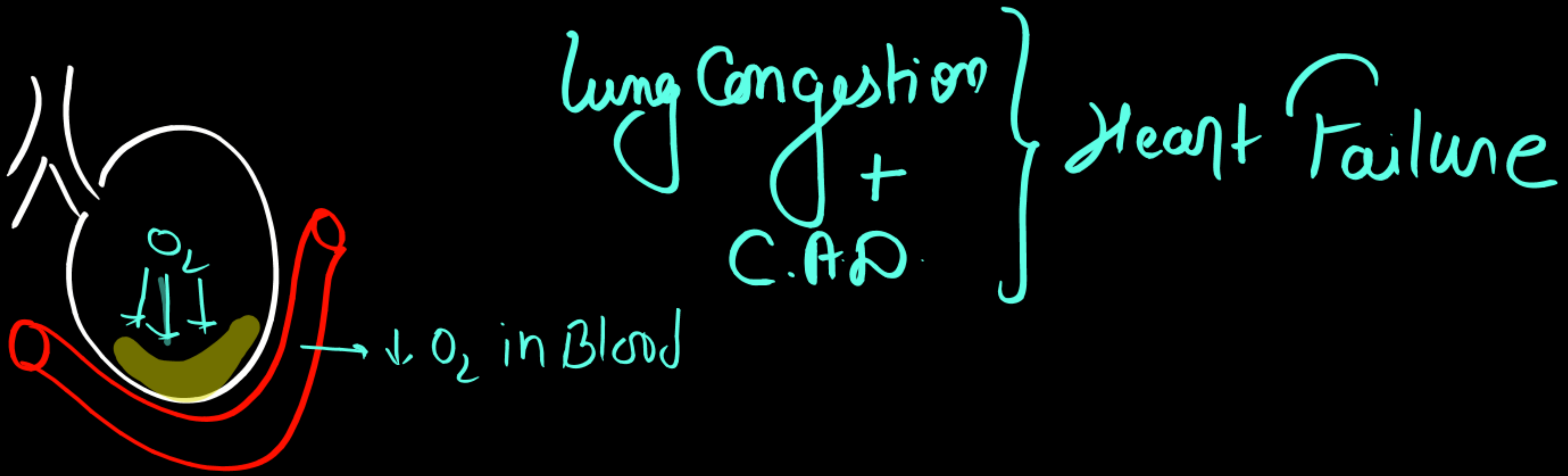
(Cardiac arrest)

(3) Angina:

- It is also called 'angina pectoris'. A symptom of acute chest pain appears when no enough oxygen is reaching the heart muscle.
- Angina can occur in men and women of any age but it is more common among the middle-aged and elderly.
- It occurs due to conditions that affect the blood flow.

(4) Heart Failure:

- Heart failure means the state of heart when it is not pumping blood effectively enough to meet the needs of the body.
- It is sometimes called congestive heart failure because congestion of the lungs is one of the main symptoms of this disease.



(5) Heart attack

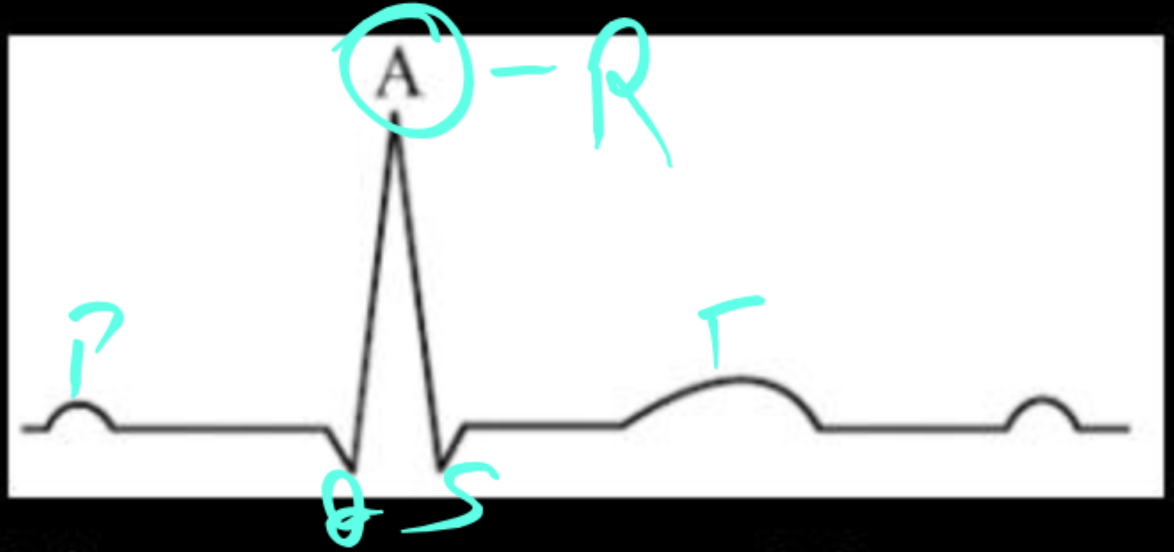
Death of a part of Cardiac Muscles

(6) Cardiac arrest

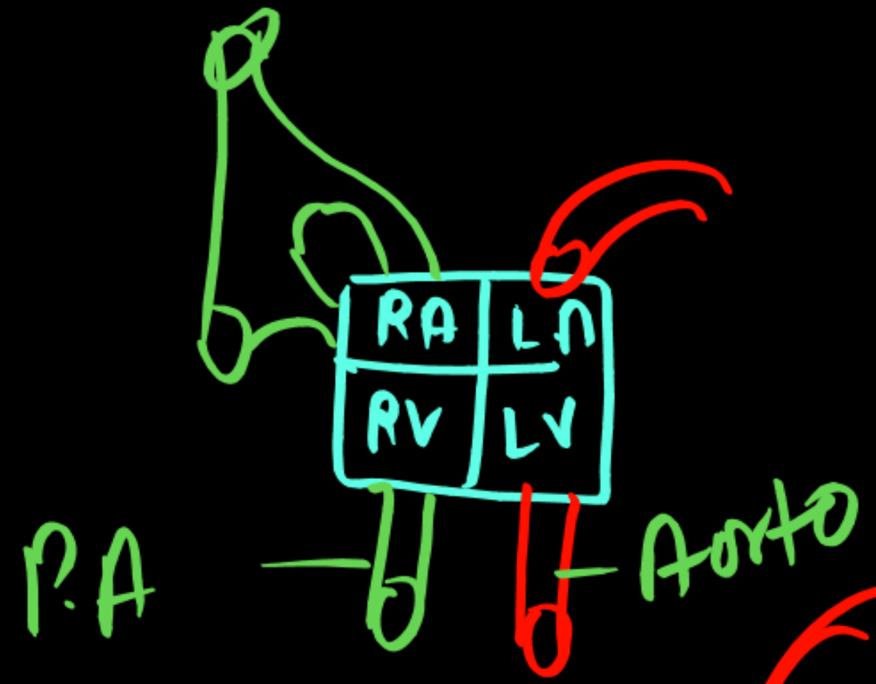
- Complete Death of Cardiac Muscles
- Cardiac output = 0
- Heart beat - Stop

} Pip-pip-pip-peee.....

1. In this figure, peak point (A) is represented by letter



(1) P (2) Q
(3) R (4) S



2. Which of the following statement is correct?

(1) Deoxygenated blood is poured into right atrium of heart
(2) The excretory units of flatworms are flame cells
(3) Human kidney has about one million nephridia
(4) Both (1) & (2)

3. During ventricular systole

(1) Oxygenated blood is pumped into the pulmonary artery and deoxygenated blood is pumped into the artery

(2) Oxygenated blood is pumped into the aorta and deoxygenated blood is pumped into the pulmonary vein

(3) Oxygenated blood is pumped into the pulmonary vein and deoxygenated blood is pumped into the pulmonary artery

(4) Oxygenated blood is pumped into the aorta and deoxygenated blood is pumped into the pulmonary artery

4

4. What happens when the pacemaker is non-functional?

(1) Only the auricles will contract rhythmically

(2) The cardiac muscles do not contract in a coordinated manner rhythmically

(3) Only ventricles will contract rhythmically

(4) Auricles and ventricles contract simultaneously

2

5. Which of the following correctly explains a phase/event in cardiac cycle in a standard electrocardiogram?

(1) QRS complex indicates atrial contraction
(2) QRS complex indicates ventricular contraction
(3) Time between S and T represents atrial systole
(4) P-wave indicates beginning of ventricular contraction

6. An adult human with average health has systolic and diastolic pressures as

(1) 120 mm Hg and 80 mm Hg
(2) 50 mm Hg and 80 mm Hg
(3) 80 mm Hg and 80 mm Hg
(4) 70 mm Hg and 120 mm Hg

7. To obtain a standard ECG, a patient is connected to the machine with three electrodes

(1) One to each wrist and to the left ankle
(2) One to each ankle and to the left wrist
(3) One to each wrist and to the left chest region
(4) One to each ankle and to the left chest region

8. Bundle of His a network of

(1) Muscle fibres distributed throughout the heart walls
(2) Muscle fibres found in the ventricle wall
(3) Nerve fibres distributed in ventricles
(4) Nerve fibres found throughout the heart

9. What would be the heart rate of a person if the cardiac output is 5 L, blood volume in the ventricles at the end of the diastole is 100 mL and at the end of ventricular systole is 50 mL?

(1) 50 beats per minute
(2) 75 beats per minute
(3) 100 beats per minute
(4) 125 beats per minute

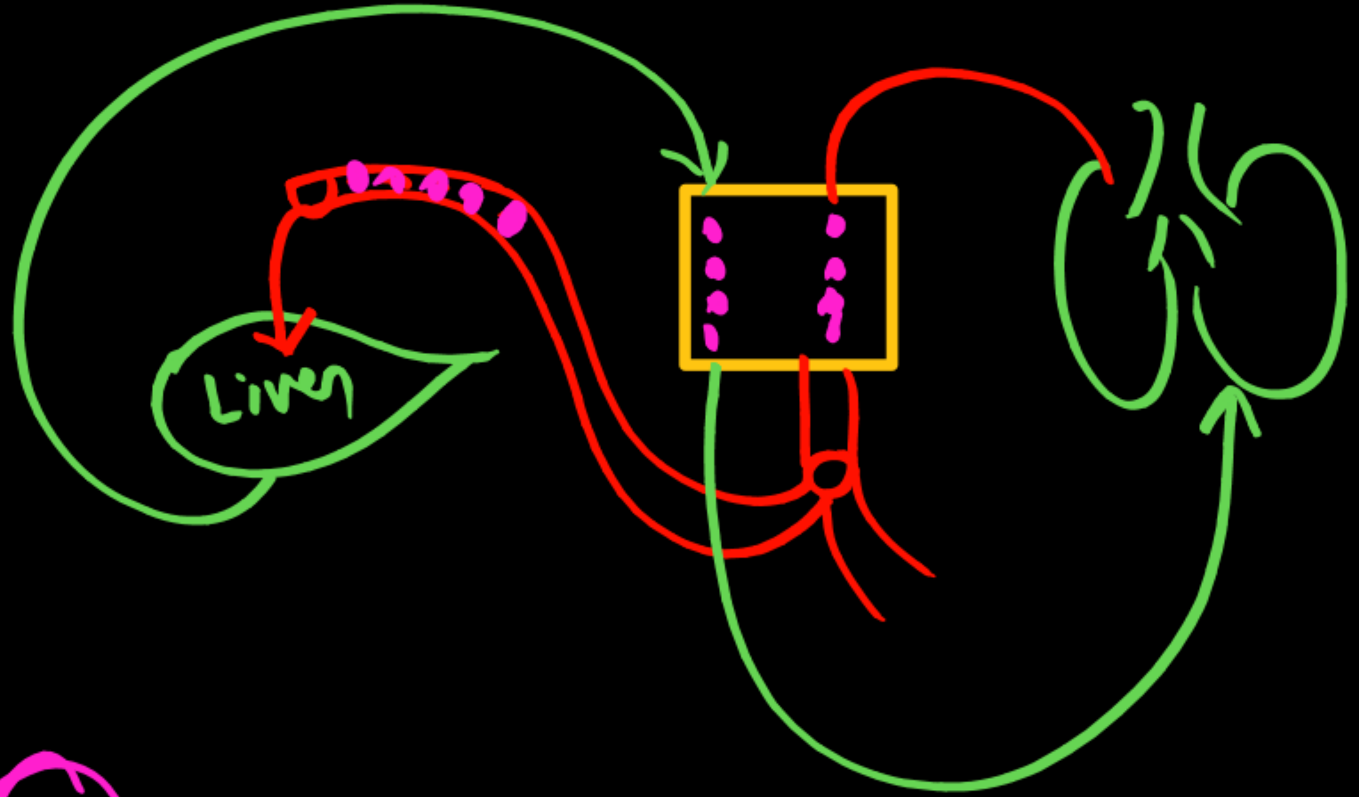
10. Cardiac output is

(1) Volume of the blood pumped out by each ventricle per minute
(2) Volume of the blood contained in the entire heart
(3) Volume of the oxygenated blood pumped by heart
(4)Volume of the deoxygenated blood pumped by heart

11. How many times a red blood corpuscle will have to pass through the heart in its journey from hepatic artery?

(1) Once (2) Two times

(3) Four times (4) Several times



12. All veins have deoxygenated blood except

(1) Renal artery

(2) Hepatic vein

(3) Hepatic portal vein

(4) Pulmonary veins

13. Functions of double circulation are

(1) Systemic circulation of nutrients and gases

(2) Absorption of harmful substances

(3) Carries blood from intestine to the kidney

(4) All of the above

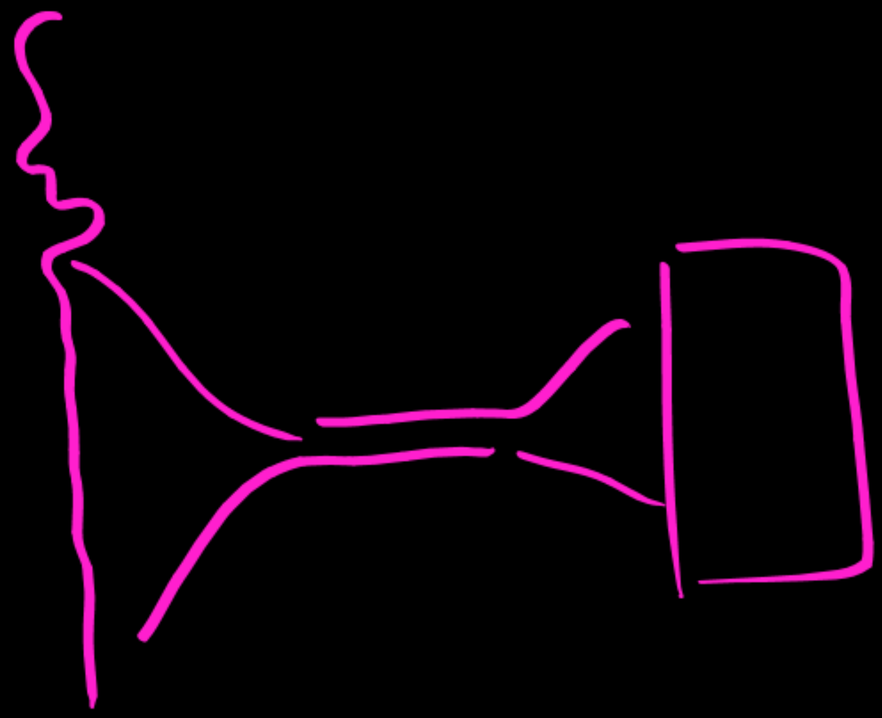
14. A unique vascular connection between the digestive tract and liver is called

(1) Hepatic portal system

(2) Renal portal system

(3) Hypophyseal portal system

(4) Coronary system



15. Double circulation is

(1) Passage of blood twice in heart through the same way
(2) Passage of blood twice in heart through the unique way
(3) Passage of blood twice in heart through the separate way
(4) None of the above

16. Right atrium receives blood from

(1) Pulmonary artery
(2) Pulmonary veins
(3) Inferior vena cava
(4) Superior and inferior vena cava

17. What would be the cardiac output of a person having 72 heart beats per minute and a stroke volume of 50 mL?

(1) 360 mL (2) 3600 mL
(3) 7200 mL (4) 5000 mL

18. Which one of the following is a correct matching pair?

(1) Lub- Sharp closure of AV valves at the beginning of ventricular systole
(2) Dup- Sudden opening of semilunar valves at the beginning of ventricular diastole
(3) AV bundle- Pacemaker
(4) Purkinje fibers- Initiation of the heart beat

19. When the heart muscle is suddenly damaged by an inadequate blood supply, it is called as

(1) Heart attack (2) Heart failure
(3) Cardiac arrest (4) CAD

20. __________ is a condition where plaque builds up on the inside of arteries

(1) Arthrocentesis (2) Arthralgia
(3) Arthritis (4) Atherosclerosis

21. Cardiac activity could be moderated by the autonomous neural system. Tick the correct answer

(1) The parasympathetic system stimulates heart rate and stroke volume
(2) The sympathetic system stimulates heart rate and stroke volume
(3) The parasympathetic system decreases the heart rate but increase stroke volume
(4) The sympathetic system decreases the heart rate but increase stroke volume

22. Myocardial infarction is caused by

(1) Hardening of arteries
(2) Lumpy thickness development in the inner walls of arteries
(3) Clot may occur in the lumen of a coronary artery
(4) Sudden interruption in blood flow towards a portion of heart

23. The thickening of walls of arteries is called

(1)	Arteriosclerosis	(2)	Arthritis
(3)	Aneurysm	(4)	Both (2) & (3)

1

24. Medulla oblangata regulates the cardiac activity via

(1)	CNS	(2)	ANS
(3)	PNS	(4)	CNS & PNS

2

25. The sympathetic nerves give ____ neural signals to heart and increases the ________

(1) Stimulatory, ventricular contraction
(2) Inhibitory, stroke volume
(3) Stimulatory, ventricular relaxation
(4) Inhibitory, ventricular relaxation

1

26. The normal blood pressure is _____ and if it gets increased, such disorder is called ____

(1) 120/80; Hypertension
(2) 80/120; Blood tension
(3) 120/80; Hypotension
(4) Both (1) & (3)

1

27. Coronary artery disease (CAD) is also referred as

(1)	Atherosclerosis	(2)	Angina
(3)	Heart failure	(4)	Heart attack

28. Which one of the following statement is true regarding angina?

(1) Heart stops beating
(2) More common in children
(3) Does not affect the blood flow
(4) No enough oxygen is reaching to heart muscles

4

29. The pumping pressure is also known as __________ and the resting pressure is also known as ________

(1) Systolic pressure, diastolic pressure
(2) Diastolic pressure, systolic pressure
(3) Normal pressure, abnormal pressure
(4) Abnormal pressure, normal pressure

1

30. Hypertension affects mainly

(1)	Intestine	(2)	Kidney
(3)	Liver	(4)	Eyes

2

THANK YOU !!

MANTHAN NEET 2025

EXCRETORY PRODUCTS AND THEIR ELIMINATION

LECTURE -1

ZOOLOGY

MD SIR



TODAY'S GOAL

- EXCRETION
- TYPES OF EXCRETORY ORGAN IN ANIMALS
- Human Excretory System

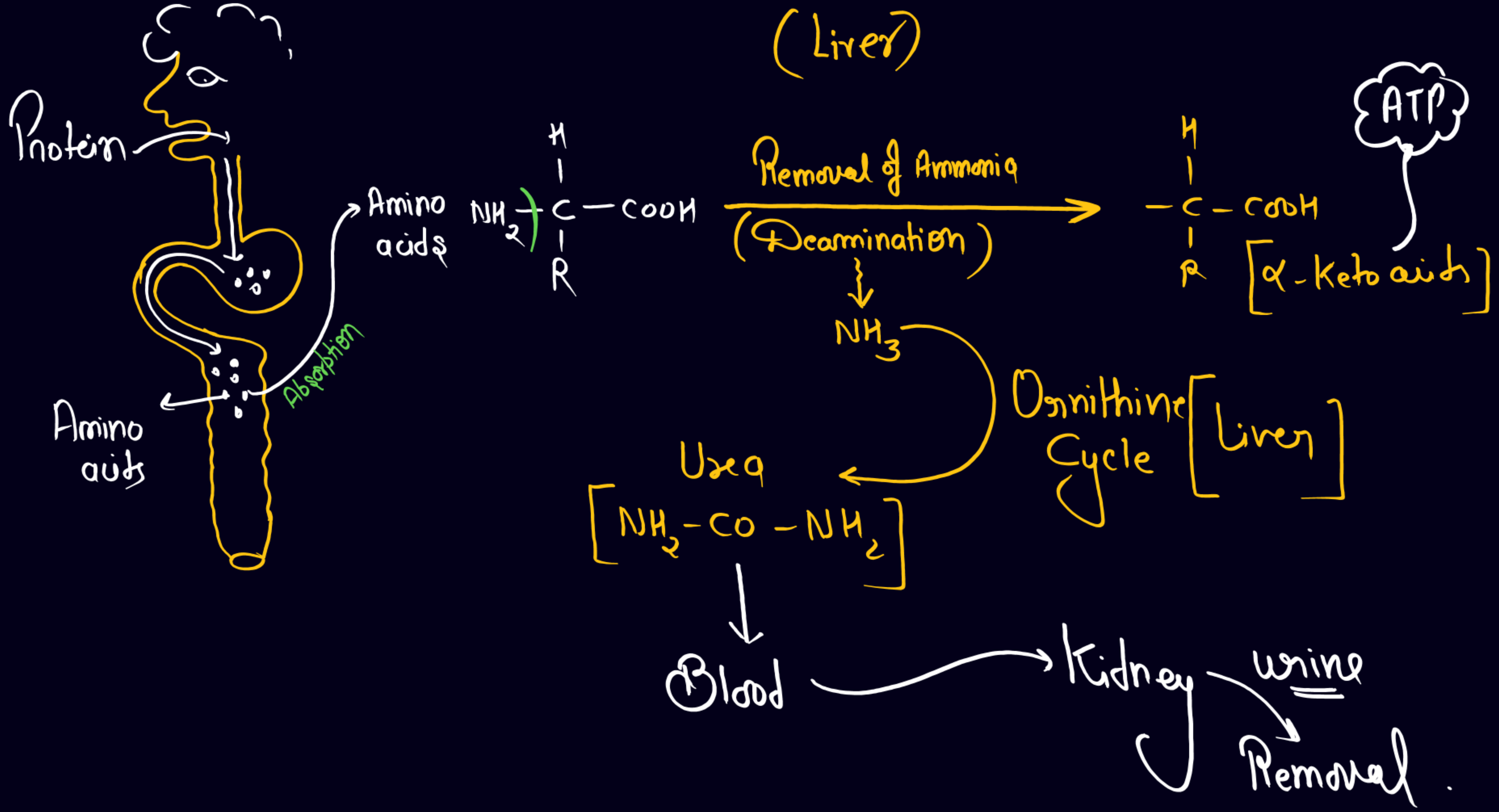
EXCRETION

Removal of Metabolic Waste like = Lactic acid, CO_2 etc and Nitrogenous Waste like = Ammonia, urea, uric acid etc. Which produced in our body, Called Excretion.

Metabolic Waste →

$$C_6H_{12}O_6 \xrightarrow{+nt\ O_2} 6CO_2 + 6H_2O + 38\ ATP$$

$$C_6H_{12}O_6 \xrightarrow{-nt\ O_2} 2\ \text{Lactic acid} + 2\ ATP$$



(Liver)
Protein
Amino acids
Absorption
Amino aids
H
NH2 — C — COOH
R
Removal of Ammonia
(Deamination)
H
— C — COOH
R
ATP
[α-Keto aids]
NH3
Ornithine Cycle
[Liver]
Urea
[NH2-CO-NH2]
Blood
Kidney
urine
Removal.

Types of Nitrogenous Waste →

1) - Ammonia (NH_3) →

*- It is pri. nitrogenous waste which produced in all animals
*- Highly toxic, not storable in our body
* Readily soluble in body fluid, for removal require lot of water
* Ammonia diffused through body surface & gills, in the form of NH_4^+.
* Kidney do not play any significant role in its removal.

Ammonotelic Animals :→

Animals remove ammonia as excretory products

eg → Aquatic arthropods

→ Larva of Amphibia

→ Bony fish.

2)- Urea ($NH_2-CO-NH_2$)

* Urea produced in Liver by = Ornithine Cycle

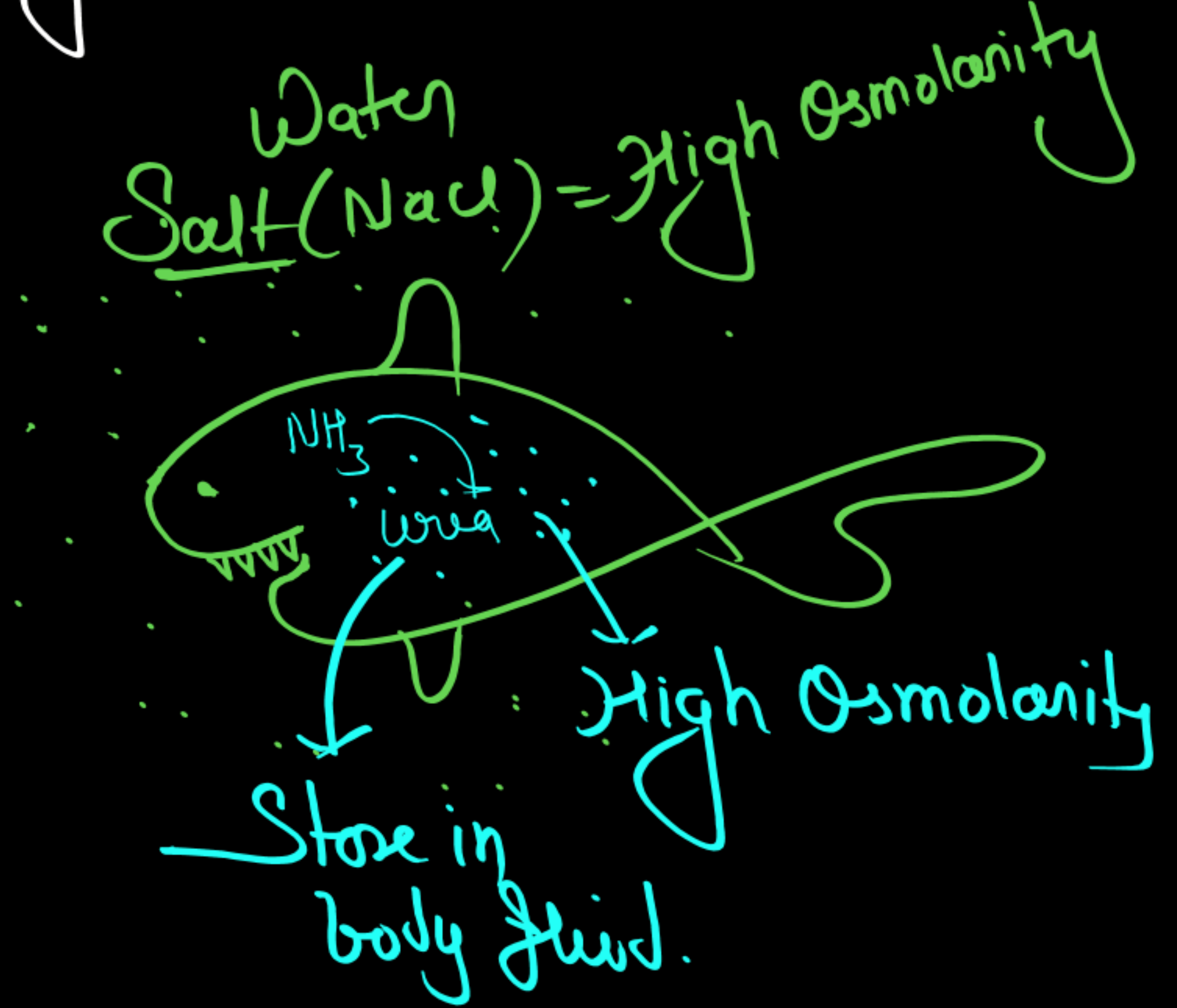
* less toxic, Small amount Storable in Own body
  - → Blood = 20-40 mg/100 ml of blood
  - → Kidney = tnt in Matrix of Kidney for maintain Osmolarity gradiant in medullary fluid

* less Soluble, for removal required less amount of Water.

Ureotelic animals →

Animals, which remove urea as excretory product

eg → Adult amphibia ✓
→ Mammals. ✓
→ Cartilagenous fish. ✓



(3) - Uric acid → ($C_5H_4N_4O_3$)

* In Birds & Reptiles, it is major end product of Protein metabolism.
* In mammals uric acid also produced by → breakdown of purins (A + G)

•) Purins ⟶ Xanthin $\xrightarrow[\text{oxidase}]{\text{Xanthin}}$ uric acid Crystals.

* Gouty Arthritis → Inflamation in joints du to deposition of uric acid crystals in joints.

uric acid
- → least toxic
- → least Soluble
- → For removal requid least amount of Water

Uricotelic animals → (Remove uric acid)
- → Insect (Cocknoack) = (Terristrial)
- → Birds.
- → Reptiles.

TYPES OF EXCRETORY ORGAN IN ANIMALS

1) - Protonephridia (Flame Cells) → • Platyhelminthes (Flat Worm → Planaria)
• Rotifer, Some annelida &
• Cephalochordata (Amphioxus)



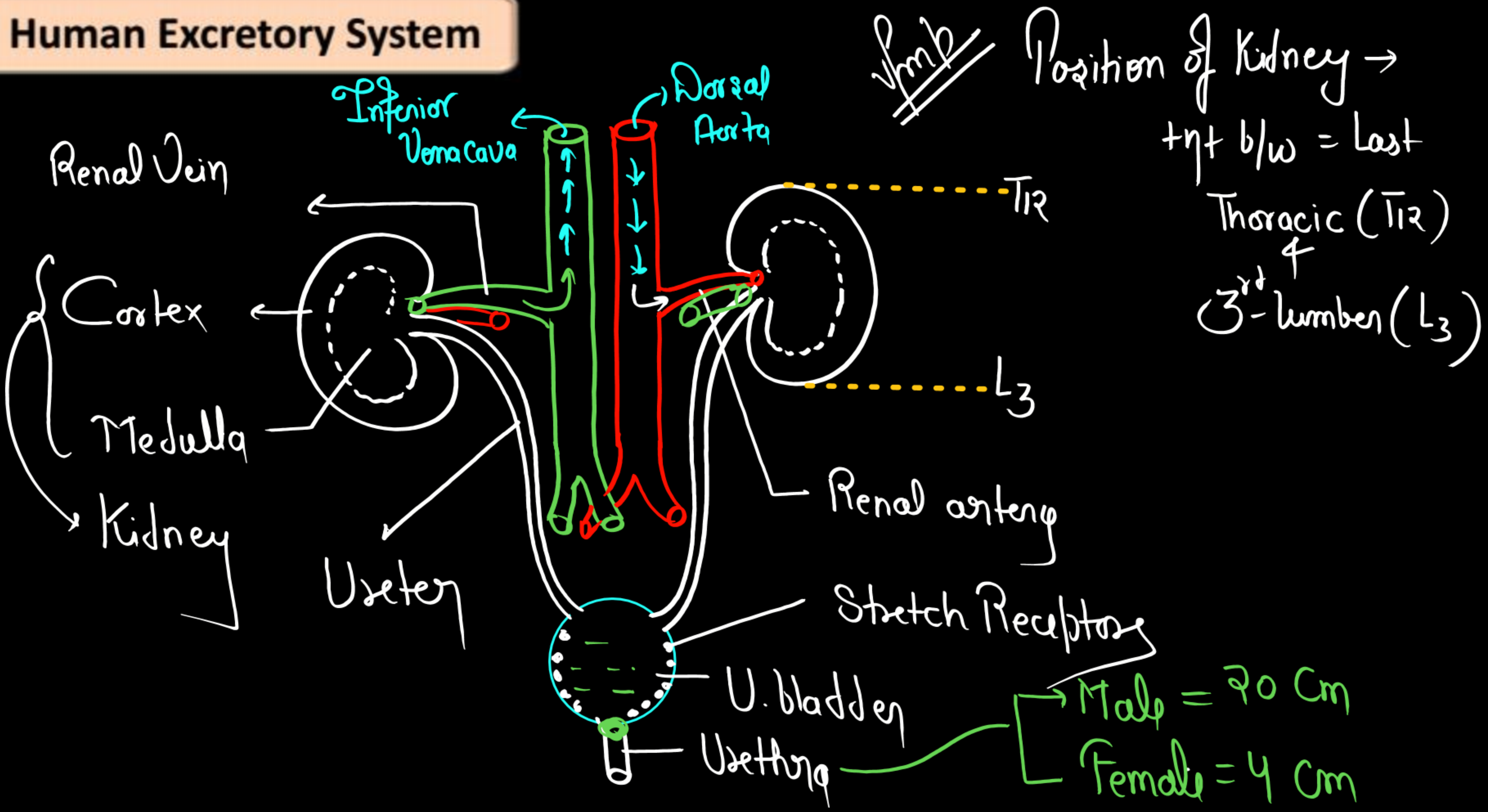
2) - Nephridia → +nt in Annelida (Earthworm)

3) - Malpighian Tubules → Insecta (Cockroach)

4) → Antenal Glands / Green Glands ⇒ Aquatic arthropods (Prawn) or (Crustacia)

5) → Kidney ⇒ All Vertebrates.

Human Excretory System



H.W.

1. Ammonia and urea are waste products derived from the metabolic breakdown of-

A) Lipids B) Carbohydrates

C) Proteins D) Sugars

2. Which of the following molecules is the most toxic to the cells?

A) NaCl B) Urea

C) Uric acid D) Ammonia

3. The terms "ammonotelic", "Ureotelic", and "Uricotelic" are used to describe-

A) Modes of excretory system development

B) The actions of hormones on the excretory systems

C) The types of nitrogenous waste produced by various classes of vertebrates

D) Modification of kidney tubules to enhance excretion

4. Which of the following statements is correct?

A) Many bony fishes, aquatic amphibia and aquatic insects are ammonotelic

B) Ammonia is readily soluble

C) NH_3 is generally excreted by the body surface or through gills (in fishes) as NH_4^+

D) All

5. NH_3 is converted into urea in -

A) Kidney
B) Liver
C) Spleen
D) Intestine

6. Which of the following groups of animals is uricotelic?

A) Reptiles
B) Insects
C) Birds and land snail
D)All

7. Excretion of nitrogenous products in semisolid forms by -

A) Uricotelic animals
B) Ureotelic animals
C) Ammonotelic animals
D) Amniotes

8. Least toxic nitrogenous waste is -

A) NH_3
B) Urea
C) Uric acid
D) NH_3 and urea

9. Which of following in small amount is retained in kidney matrix of some animals to maintain a desired osmolarity?

A) NH_3
B) Urea
C) Uric acid
D) NH_3 and uric acid

10. Which of the following is correct about protonephridia/flame cells?
A) Protonephridia are the excretory structures in Platyhelminthes (e.g. Planaria), rotifers and some annelids
B) Protonephridia are the excretory structures in the cephalochordates e.g. Amphioxus
C) Protonephridia are primarily concerned with ionic and fluid volume regulation i.e. osmoregulation
D) All

11. Which of the following statements is wrong about the human excretory system?
A) Excretory system consists of one pair of bean shaped kidneys, one pair of ureter, a urinary bladder and a urethra.
B) Kidneys are situated between the 12th thoracic and 3rd lumbar vertebrae close to the dorsal wall in abdominal cavity.
C) Right kidney is a little higher level than the left one.
D) All

THANK YOU !!

MANTHAN NEET 2025

EXCRETORY PRODUCTS AND THEIR ELIMINATION

LECTURE -2

ZOOLOGY

MD SIR



TODAY'S GOAL

- Human Excretory System
- Mechanism of Micturition
- Structure of Kidney and Nephron

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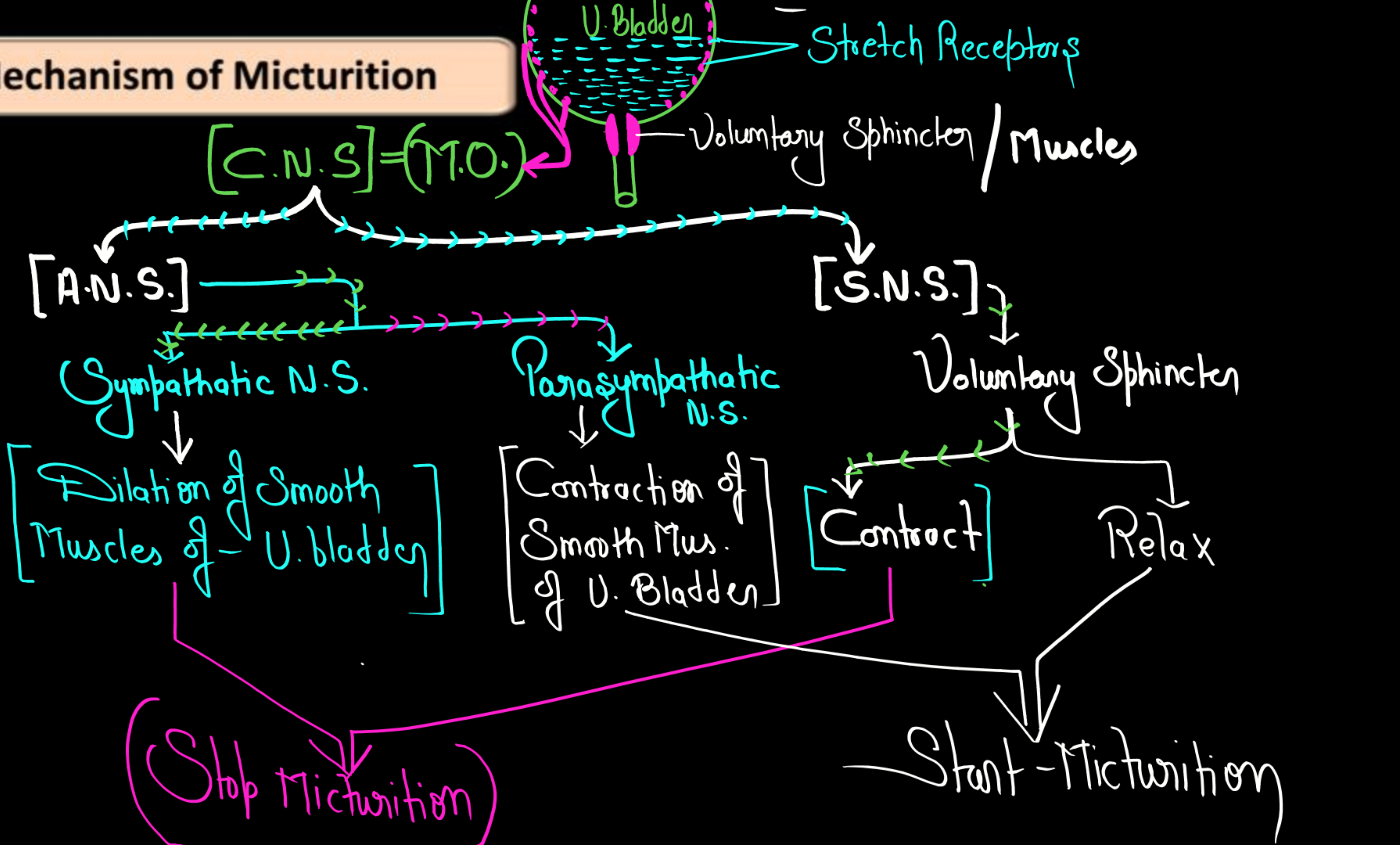
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D) All

Mechanism of Micturition



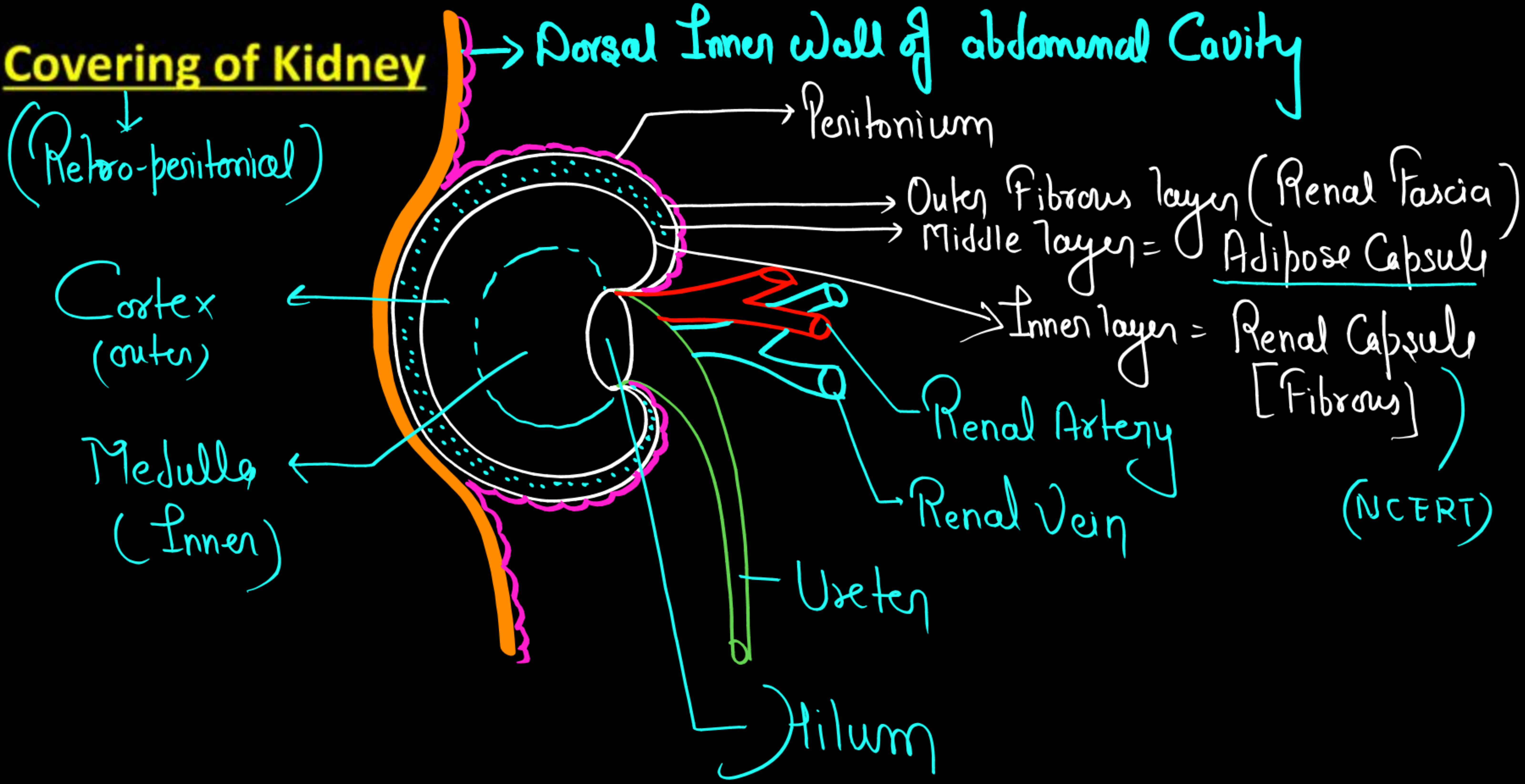
Kidney

- Kidneys are reddish brown, bean shaped structures situated between the levels of last thoracic and third lumbar vertebra close to the dorsal inner wall of the abdominal cavity.

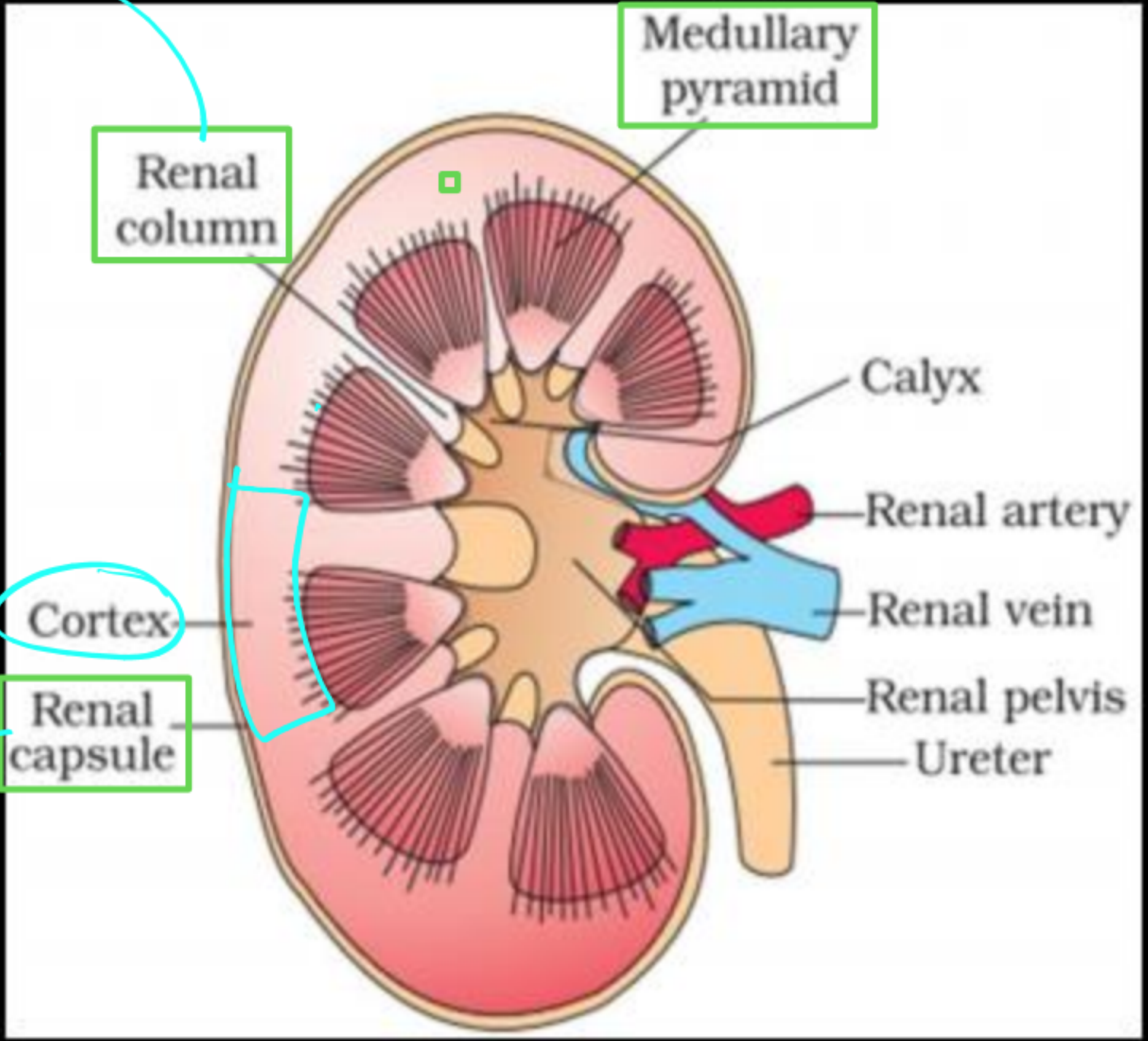
- Each kidney of an adult human measures 10-12 cm in length, 5-7 cm in width, 2-3 cm in thickness with an average weight of 120- 170 g.

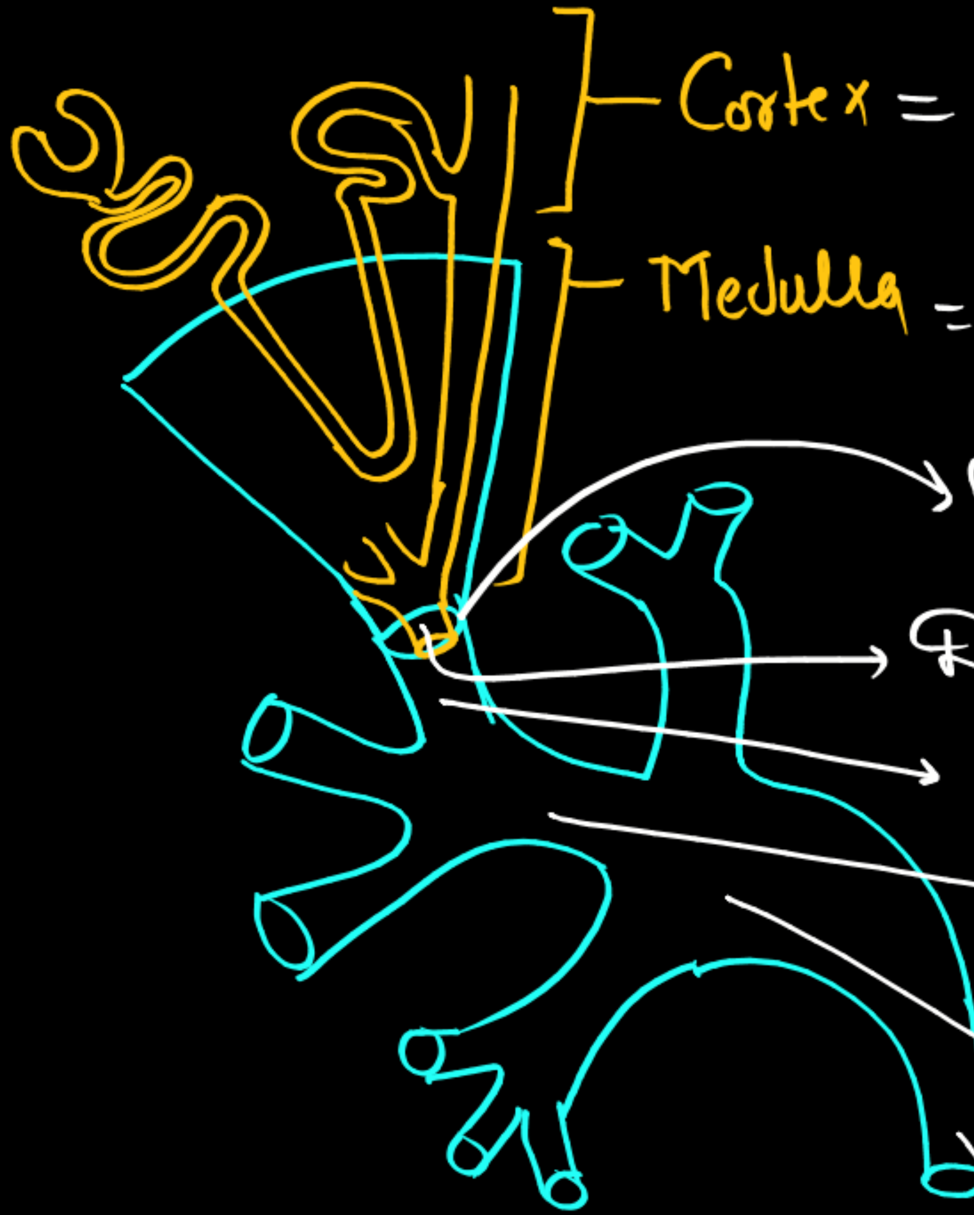


Covering of Kidney



Structure of Kidney





Cortex = B.C. + P.C.T + D.C.T.

Medulla = L.H. + C.D.

Renal papilla → Duct of Bellini → Minor Calyx (8-12) → Major Calyx (3-4) → Pelvis → Ureter → U.Bladder → Urethra

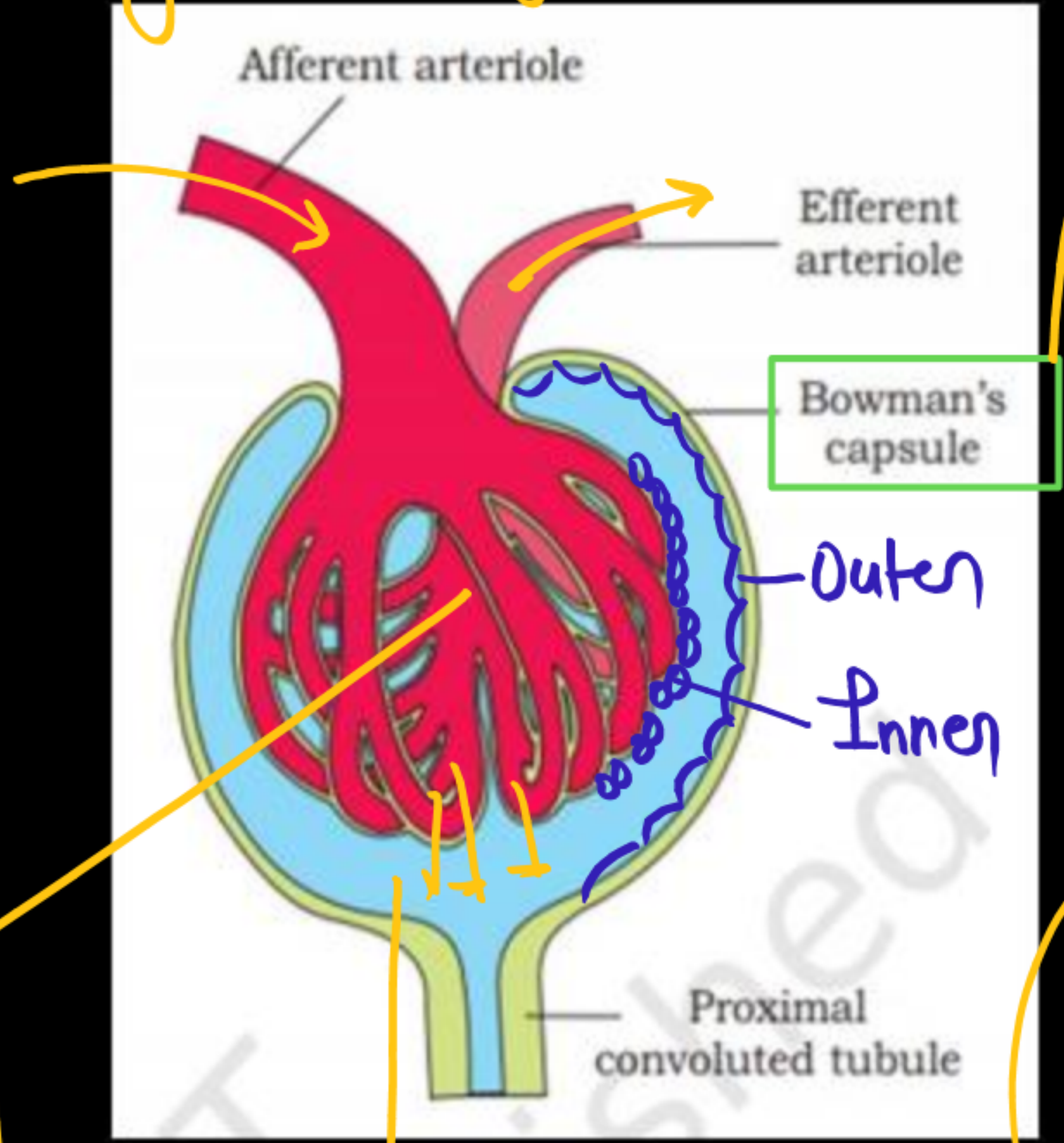
Structure of Nephron -

- Uriniferous Tubules
- Unit of Kidney
- No. of Nephron in both Kidney = 2 - Million

- Glomerulus ✓
  [Network of Capillary]
- Renal Tubules → B.C. + P.C.T. + L.H. + D.C.T. → CD

Glomerulus + B.C. → Malpighian Body (vvvImp)

Malpighian body →



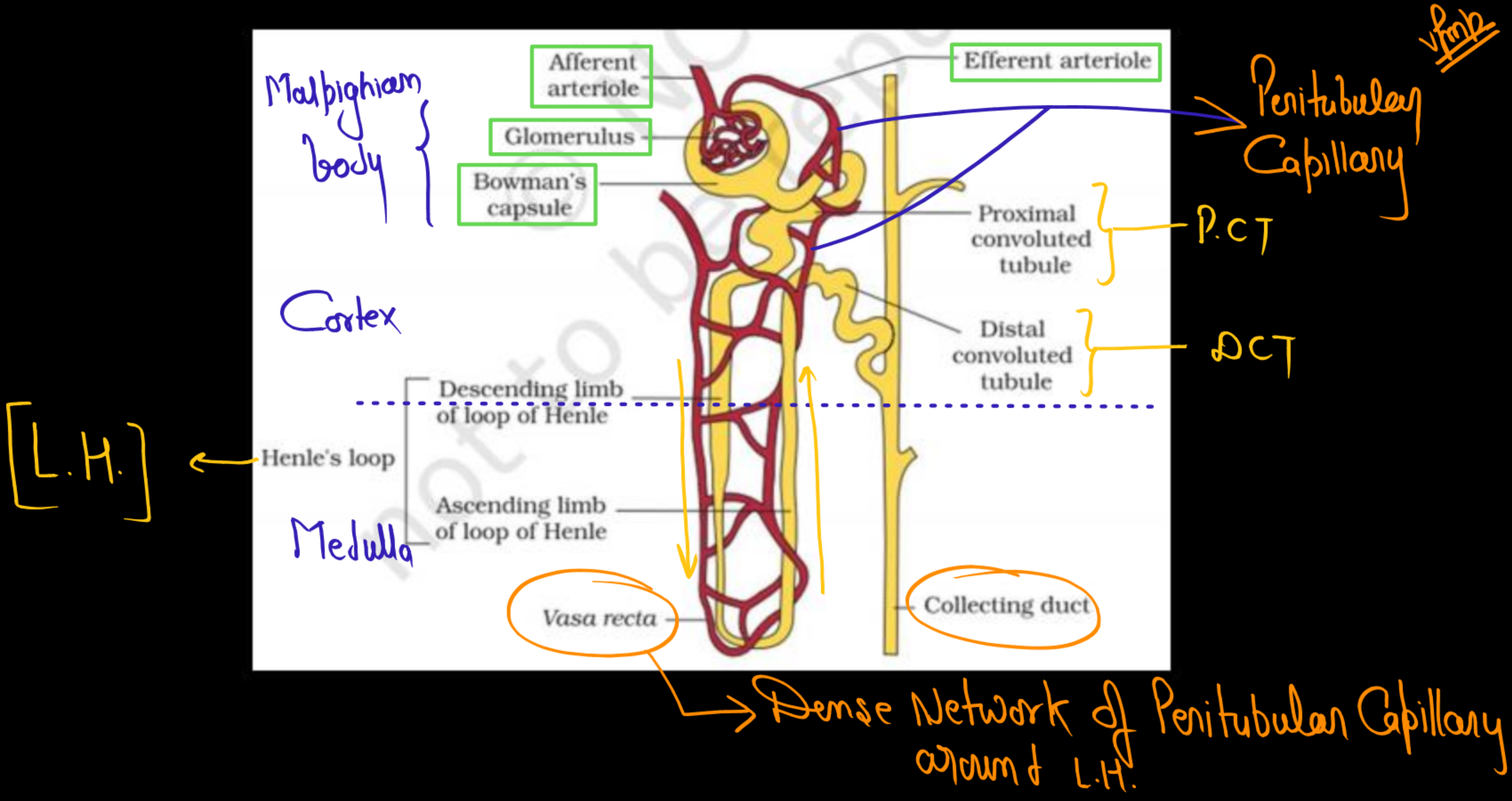
Glomerulus
+
B.C.

Wall of Bowman's Capsule

- Outer [Parietal layer] → Simple Squamous Epithelium
- Inner [Visceral layer] → [Podocytes]

No. of Diffusion Layer = 3




Afferent arteriole
Glomerulus
Bowman's capsule
Efferent arteriole
Proximal convoluted tubule
Distal convoluted tubule
Descending limb of loop of Henle
Henle's loop
Ascending limb of loop of Henle
Vasa recta
Collecting duct
Malpighian body
Cortex
Medulla
[L.H.]
Peritubular Capillary
P.C.T
D.C.T
Dense Network of Peritubular Capillary around L.H.

(H.W.)

1. Which of the following statements is false?

I. Outer cortex and inner medulla are the two zones in kidney

II. Medulla is divided into about 8 to 18 renal pyramids

III. Pyramid projects into calyx

IV. Inwards extension of cortex between the pyramids is called renal column of Bertini

A) I and IV B) II and IV

C) IV D) None

2. Renal corpuscle or Malpighian body is-

A) Glomerulus only

B) Glomerulus along with Bowman's capsule

C) Bowman's capsule

D) Glomerulus with afferent arteriole

3. Which one of the following is a tube that carries urine from kidney to the urinary bladder?

A) Loop of Henle B) Ureter

C) Urethra D) Uvula

4. All of the following structures are situated in the renal cortex except -

A) Loop of Henle
B) Malpighian corpuscle
C) PCT
D) DCT

5. The DCTs of many nephrons open into a straight tube called –

A) PCT
B) Loop of Henle
C) Collecting duct
D) Bowman's capsule

6. Which of the following statements is false?

A) Renal tubule starts with a double walled cup like structure called Bowman's capsule
B) In majority of nephrons, the loop of Henle is too short and such nephrons are cortical nephrons
C) Juxta medullary nephron has long loop of Henle
D) None

7. Which is the correct pathway for passage of urine in humans?

A) Collecting tubule→ ureter→ bladder→ urethra
B) Renal vein→ renal ureter→ bladder→ urethra
C) Pelvis→ Medulla → bladder→ urethra
D) Cortex→ Medulla→ bladder→ ureter

8. In glomerulus, afferent arteriole –
A) Is wider than efferent arteriole
B) And efferent arteriole has similar diameter
C) Is narrower than efferent arteriole
D) Is narrow than efferent capillaries

9. Which of the following is incorrect?
A) Blood vessel leading to glomerulus is called efferent arteriole
B) Vasa recta, peritubular capillaries, Glomerulus all have blood
C) Cortical nephron has no or highly reduced vasa recta
E) Vasa recta runs parallel to the Henle's loop in juxtamedullary nephrons

10. Vasa recta is –
A) L-shaped		B) S-shaped
C) U-shaped		D) J-shaped

THANK YOU !!

MANTHAN NEET 2025

EXCRETORY PRODUCTS AND THEIR ELIMINATION

LECTURE -3

ZOOLOGY



MD SIR

TODAY'S GOAL

- Structure of Nephron
- Types of Nephron
- Urine formation

Types of Epithelium in Nephron

- B.C. → Simple Squamous Epi. Tissu.



- P.C.T. → Brush Bordened Cuboidal Epithelium



- L.H.
  - ↓ Des. L.H. → Simple Squa. Epi. Tissu



  - ↑ Ascen. L.H. → Simple Cuboidal



- D.C.T. → Simple Cuboidal



- C.D. → Simple Cuboidal

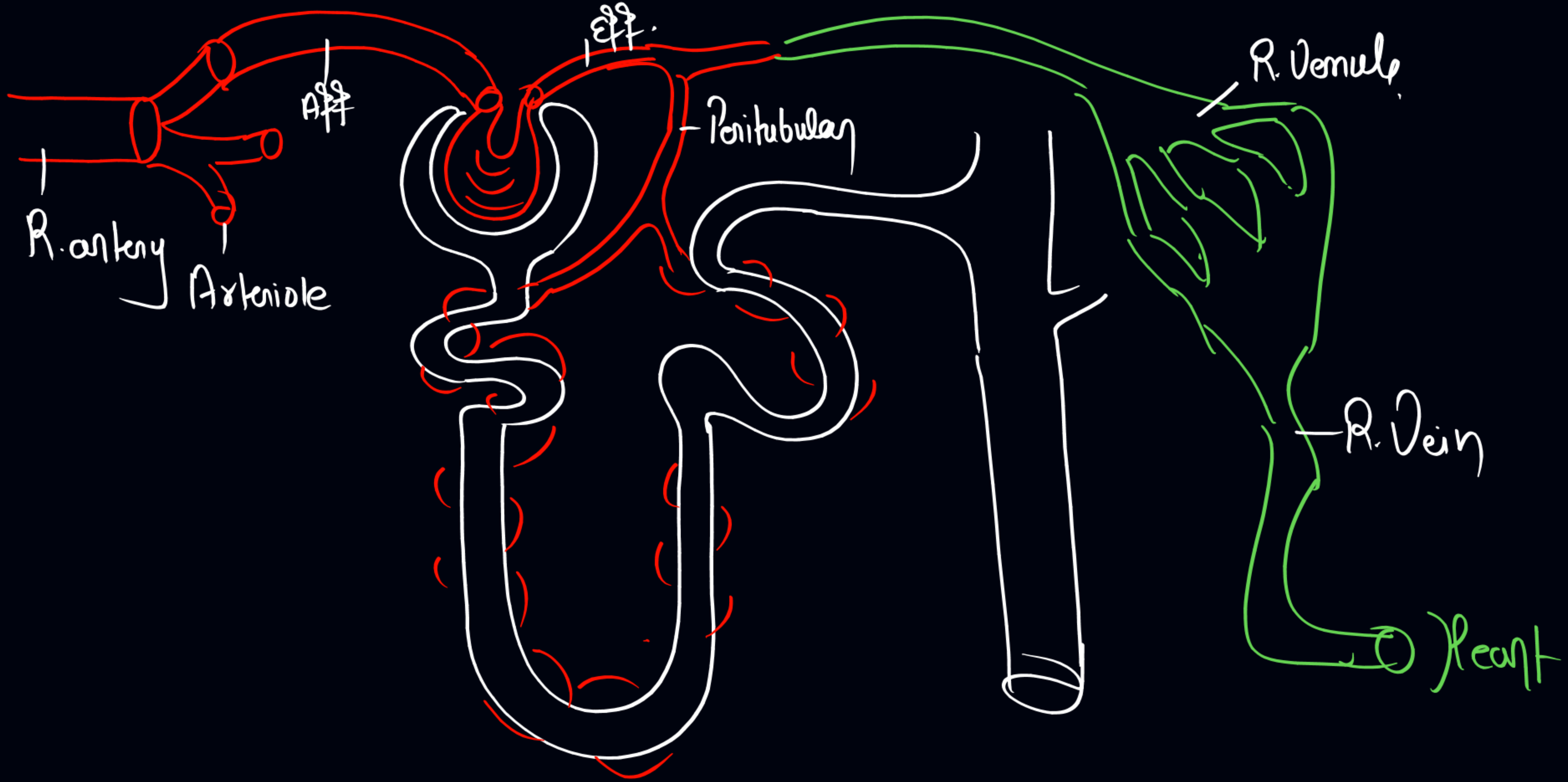


Passage of Urine

CD → Duct of bellini → Minor Calyx → Major Calyx → Pelvis → Uretar → U.bladder → urethra.

Passage of Blood

Renal artery → R. arteriole → Aff. arterioles → Network of Capillary [Glomerulus] → Eff. arterioles → Peritubular Capillary → R. Venules → R. Vein → Heart


Eff.
Aff
R. Venule
Peritubular
R. artery
Arteriole
R. Vein
Heart

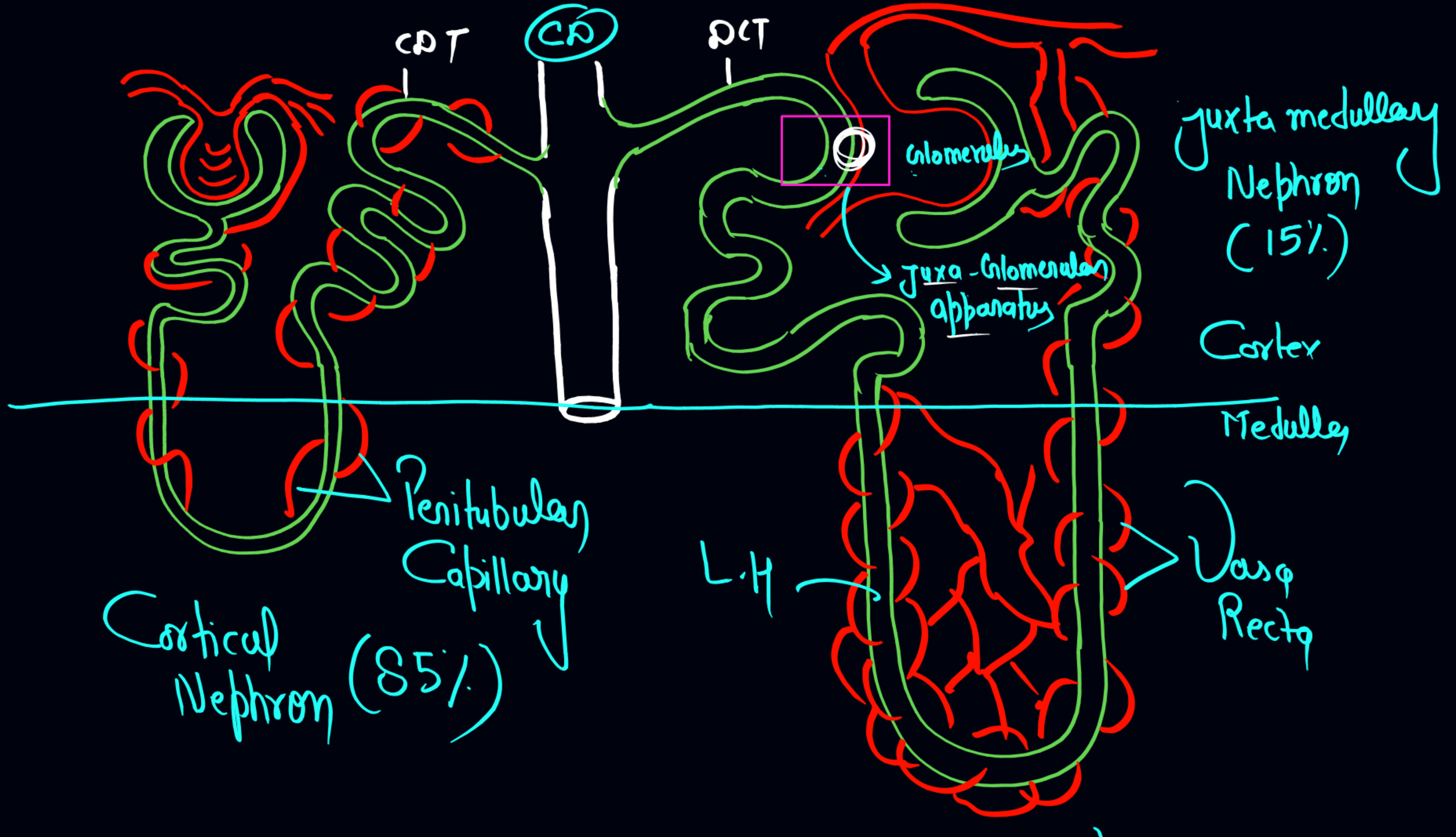
Types of Nephron

Cortical Nephron

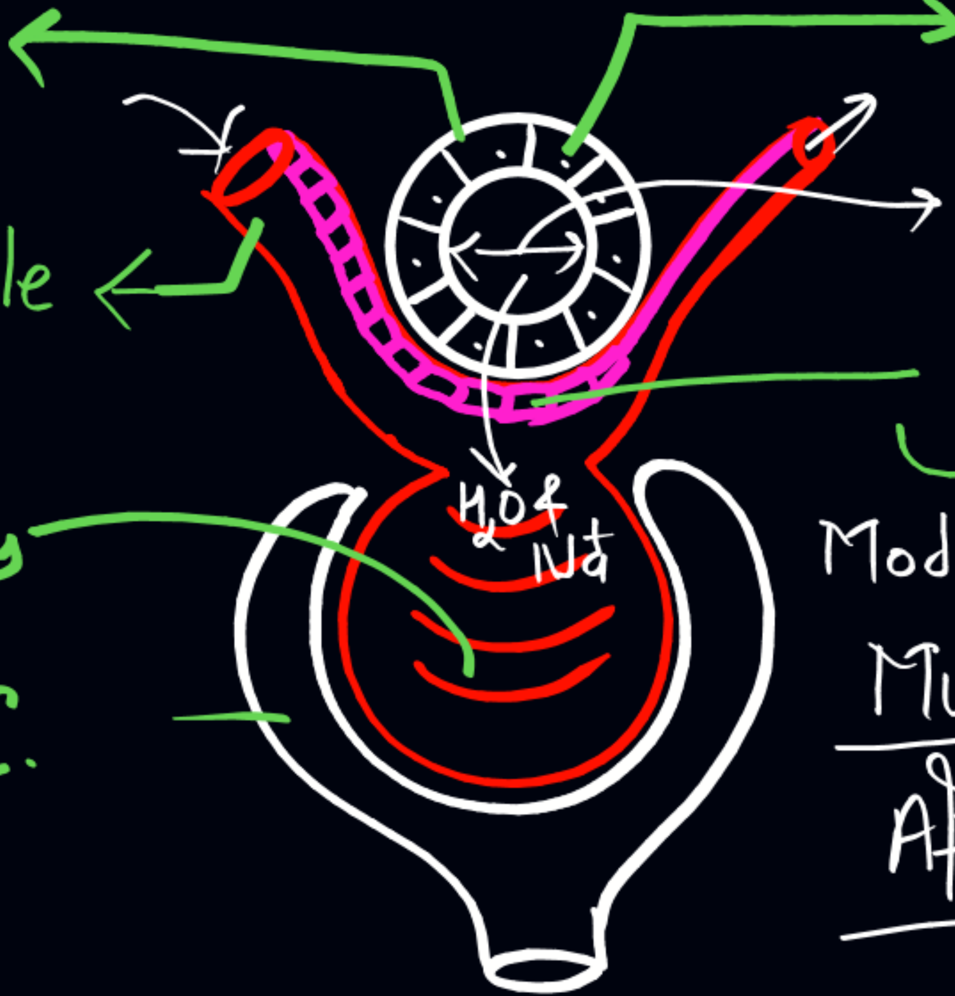
* [85%] = Normal
* Max^m part tnt in Cortex
* Size = Small
* L.H = Short
* Vasa Recta = -nt
* Juxta Glomerular apparatus = -nt

Juxta Medullary Nephron

* [15%] = Emergency
* Max^m part tnt in Medulla
* Size = Large
* L.H = Long
* tnt
* tnt


CDT
CD
DCT
Glomerulus
Juxta-Glomerular apparatus
Juxta medullary Nephron (15%)
Cortex
Medulla
Peritubular Capillary
L.H
Vasa Recta
Cortical Nephron (85%)

Juxta glomerular apparatus →



Modified Smooth Muscles of mainly Aff. arteriole.

} Juxta Glomerular Apparatus

vv Imp

JG Cells
↙ ↓
Juxta Glomerular cells

Function of J.G. Cells →

1) - Release Renin = Control
- Blood Pressure
- G.F.R. (Glomerular Filtration Rate)

2) - Release = Erythropoietin Hormone ⇒ Erythropoiesis [Formation of R.B.C]

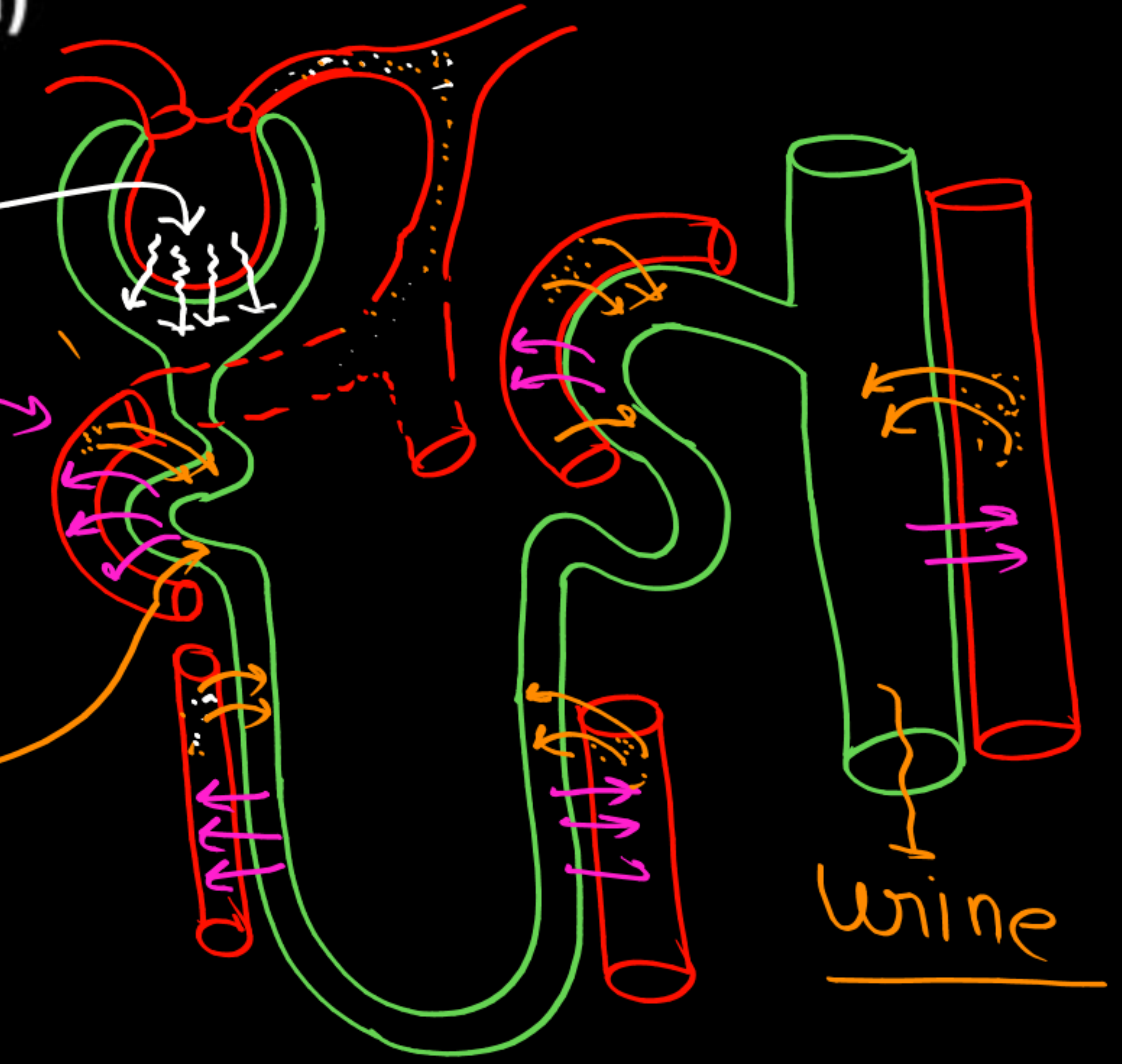
3) - Release = Calcitriol (Vit-D_3)
↳ ↑ - absorption of Ca^{++} from Gut food.

Urine Formation

(1) Glomerular filtration (Ultra filtration)

(2) Reabsorption

(3) Secretion



1. Which of the following statements is false?
I. Outer cortex and inner medulla are the two zones in kidney
II. Medulla is divided into about 8 to 12 renal pyramids
III. Pyramid projects into calyx
IV. Inwards extension of cortex between the pyramids is called renal column of Bertini

A) I and IV B) II and IV
C) IV D) None

2. Renal corpuscle or Malpighian body is-

A) Glomerulus only
B) Glomerulus along with Bowman's capsule
C) Bowman's capsule
D) Glomerulus with afferent arteriole

3. Which one of the following is a tube that carries urine from kidney to the urinary bladder?

A) Loop of Henle B) Ureter
C) Urethra D) Uvula

4. All of the following structures are situated in the renal cortex except -

A) Loop of Henle
B) Malpighian corpuscle
C) PCT
D) DCT

5. The DCTs of many nephrons open into a straight tube called –

A) PCT
B) Loop of Henle
C) Collecting duct
D) Bowman's capsule

6. Which of the following statements is false?

A) Renal tubule starts with a double walled cup like structure called Bowman's capsule
B) In majority of nephrons, the loop of Henle is too short and such nephrons are cortical nephrons
C) Juxta medullary nephron has long loop of Henle
D) None

7. Which is the correct pathway for passage of urine in humans?

A) Collecting tubule→ ureter→ bladder→ urethra
B) Renal vein→ renal ureter→ bladder→ urethra
C) Pelvis→ Medulla → bladder→ urethra
D) Cortex→ Medulla→ bladder→ ureter

8. In glomerulus, afferent arteriole –
A) Is wider than efferent arteriole
B) And efferent arteriole has similar diameter
C) Is narrower than efferent arteriole
D) Is narrow than efferent capillaries

9. Which of the following is incorrect?
A) Blood vessel leading to glomerulus is called efferent arteriole
B) Vasa recta, peritubular capillaries, Glomerulus all have blood
C) Cortical nephron has no or highly reduced vasa recta
E) Vasa recta runs parallel to the Henle's loop in juxtamedullary nephrons

10. Vasa recta is –
A) L-shaped
B) S-shaped
C) U-shaped
D) J-shaped

H.W.

1. Urine formation involves-

A) Ultra filtration and reabsorption occurring in different parts of nephron

B) Ultrafiltration and reabsorption occurring in same part of nephron

C) Ultrafiltration, reabsorption and secretion occurring in different parts of nephron

D) Ultrafiltration, reabsorption and secretion occurring in same part of nephron

2. Which of the following statements is correct?

I. Renal vein take blood away from kidney

II. Loop of Henle conserves water

III. Podocytes occur in inner wall of Bowman's capsule

IV. Ultrafiltrate I nephric filtrate is plasma minus proteins.

A) I and II B) I and III

C) III and IV D) I, II, III, IV

3. The glomerular capillaries cause filtration of blood through ___3___ layers –

A) 1 B) 2

C) 3 D) 6

4. On average, _______ mL of blood is filtrated by the kidney per minute which constitute roughly __ of the blood pumped out by each ventricle of heart in a minute. –

A) 125 ml, 1/6th

B) 100 -125 ml, 1/6th

C) 1100 -1200 ml, 1/5th

D) 5 L, $1/10^{th}$

5. The amount of the filtrate formed by the kidney I minute is called GFR (Glomerular Filtration Rate). The GFR of a healthy adult is- –

A) 80 mL/min

B) 125 mL/min

C) 300 mL/min

D) 20 mL/min

6. The GFR/day in a healthy adult is -

A) 5L B) 180L

C) 200 L D) 20 L

7. Juxtaglomerular apparatus, a special sensitive cellular region is formed in -
A) PCT and DCT
B) PCT and DCT at the location of their contact
C) PCT and loop of Henle at the location their contact
D) DCT and afferent arteriole at the location of their contact

8. Of the filtrate, nearly how many of it is reabsorbed by the renal tubules?
A) 5% B) 99%
C) 50% D) 25%

9. Which of following statements is false?
A) The kidney has built in mechanism for regulation of GFR
B) Tubular secretion does not play any significant role in urine formation
C) The amount of urine output per day in normal adult is about 1.5 L
D) During urine formation tubular cells secrete H^+, K^+ and NH_3 in the filtrate

THANK YOU !!

MANTHAN NEET 2025

EXCRETORY PRODUCTS AND THEIR ELIMINATION

LECTURE -4

ZOOLOGY



MD SIR

TODAY'S GOAL

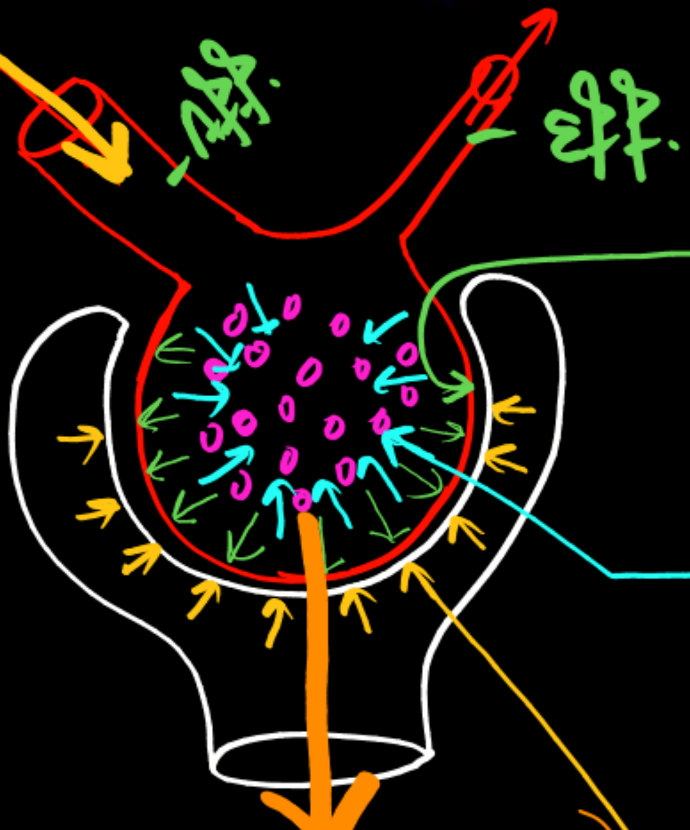
- Urine formation
- Function of Tubules
- Counter current Mechanism

Urine Formation

(1) Glomerular filtration (Ultra filtration)
(2) Reabsorption
(3) Secretion

(1) Glomerular filtration (Ultra filtration)

1100-1200 ml
Blood Flow by Kidney
Per minute
or
[1/5 (20%) of C.O.]



Glomerular Hydrostatic Pressure
G.H.P. = 55 mm Hg (+ve) ✓

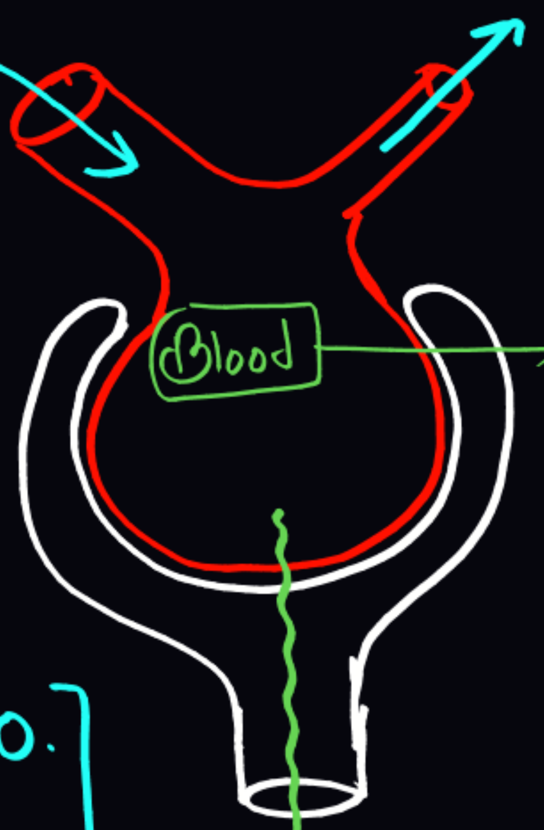
Blood Colloidal Osmotic Pressure
B.C.O.P = 30 mm Hg (−ve) ✓

Capsular Hydrostatic Pressure
C.H.P = 15 mm Hg (−ve) –

(10-mmHg)

① N.F.P. = G.H.P − [BCOP + C.H.P]
= 55 − [30 + 15]
= 55 − 45
= 10 mm Hg

2)- G.F.R →



① 1100-1200 ml blood flow by Kidney / minute

or

[1/5 or 20% of C.O.]

or

≃ 650 ml (55%) Plasma flow by Kidney / minute

Filtrate [like Plasma − Protein]

- 125 ml filtrate / minute = 20% of Plasma } → G.F.R / Day — 180 l / Day

vvvImp



99% Reabsorbe in blood

Only 1% Convert into urine } 1.8 l / Day

(2) Tubular Reabsorption

(a) Reabsorption from Proximal Convoluted Tubule (PCT):

→ Max^{m} active Transport
→ Max^{m} – Mitochondria

→ Max^{m} (70-80%) Reabsorption
→ 70-80% Water + Minerals = Reabsorbe
→
- Glucose } 100%
- Amino acid } 100%
- Vit-C
- +ve ions Na^+, K^+ etc

→ Through = Active Transport } ATP

- -ve ions Cl^-, HCO_3^- etc } → Passive Transport [Without ATP]
- Water } → Osmosis.

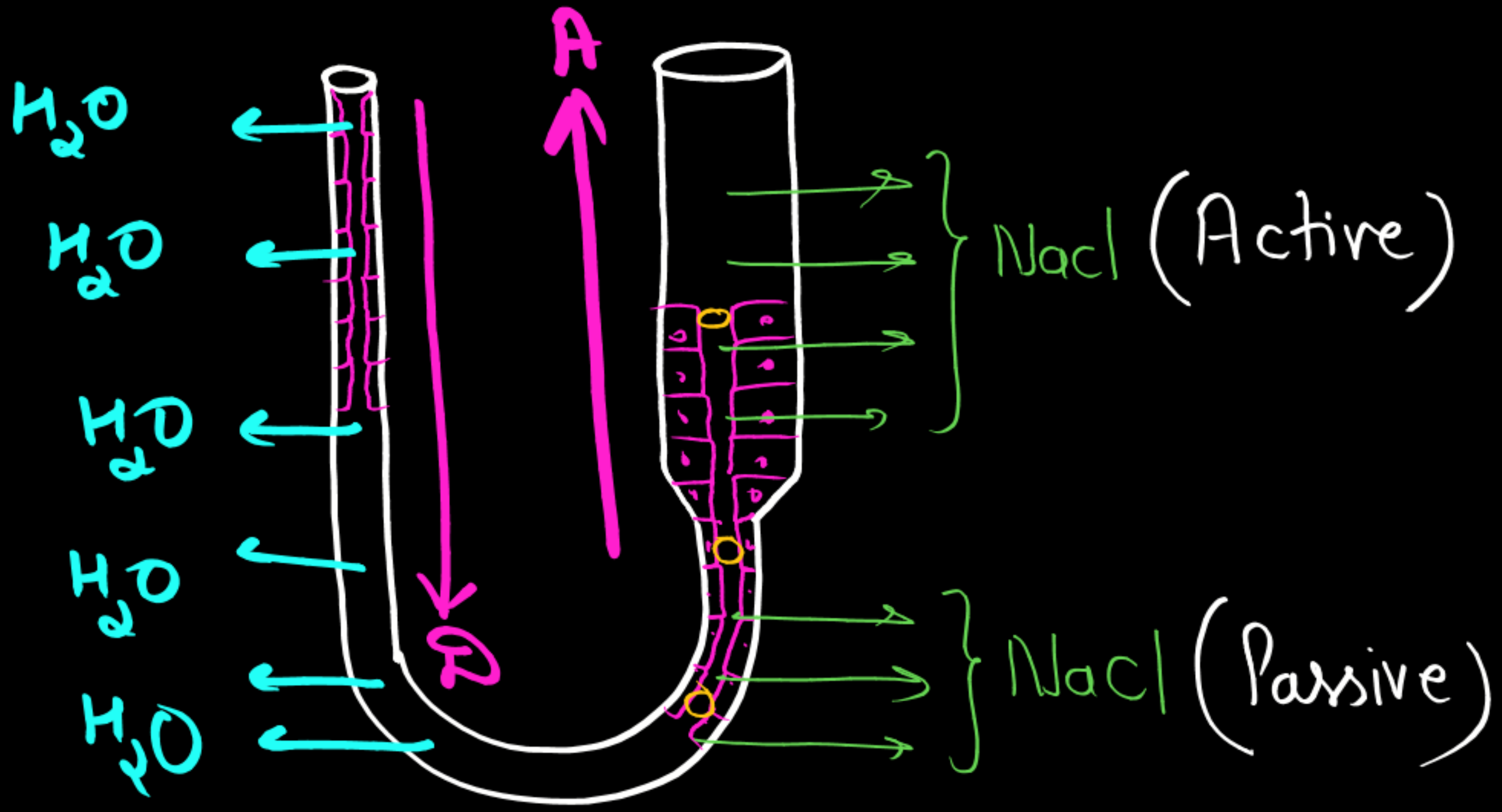


→ Brush Bordered Cuboidal Epi. Tissue

MicroVilli
+
↑ - Surface area for absorption

(b) Reabsorption from L.H. :

→ Min^m (5%) Reabsorption of
- H_2O
- NaCl



- ↓ Descending
  - Thin → H_2O [Osmosis]
- ↑ Ascending
  - Thin → Nacl [Passive]
  - Thick → Nacl [Active]

vImp

(c) Reabsorption from D.C.T. :

- → Conditional Reabsorption [15%]
  - of → Na^+ (Active) → Aldosteron
  - → Water (Passive) → ADH (Vasopressin)
- → HCO_3^- also reabsorbe from DCT.

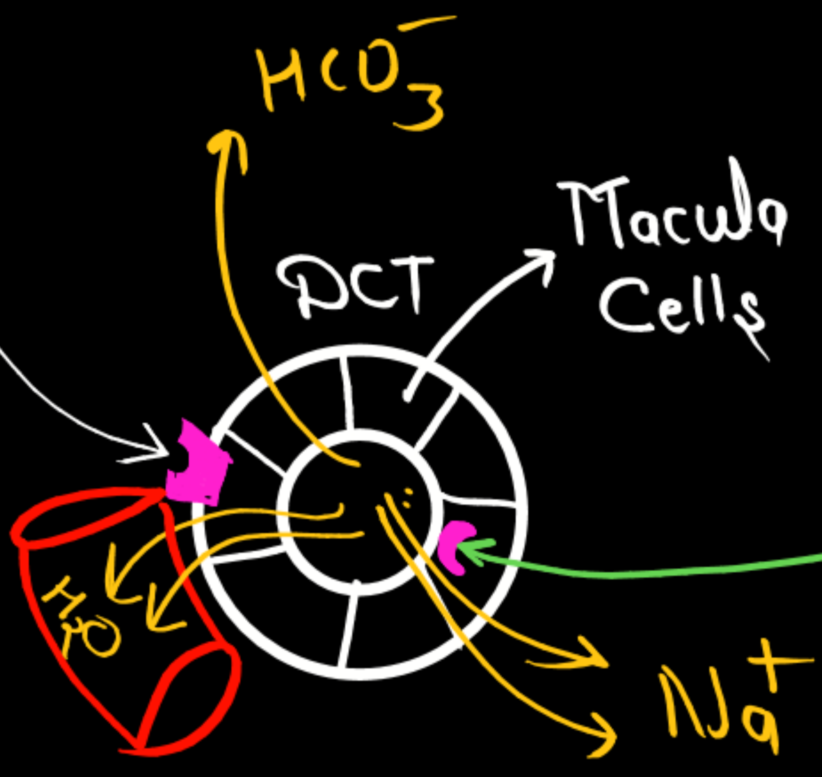
Hypothalamus

↓

Release ADH from P. Pituitary

↓

Absorption of H_2O



Release Aldosteron

↓

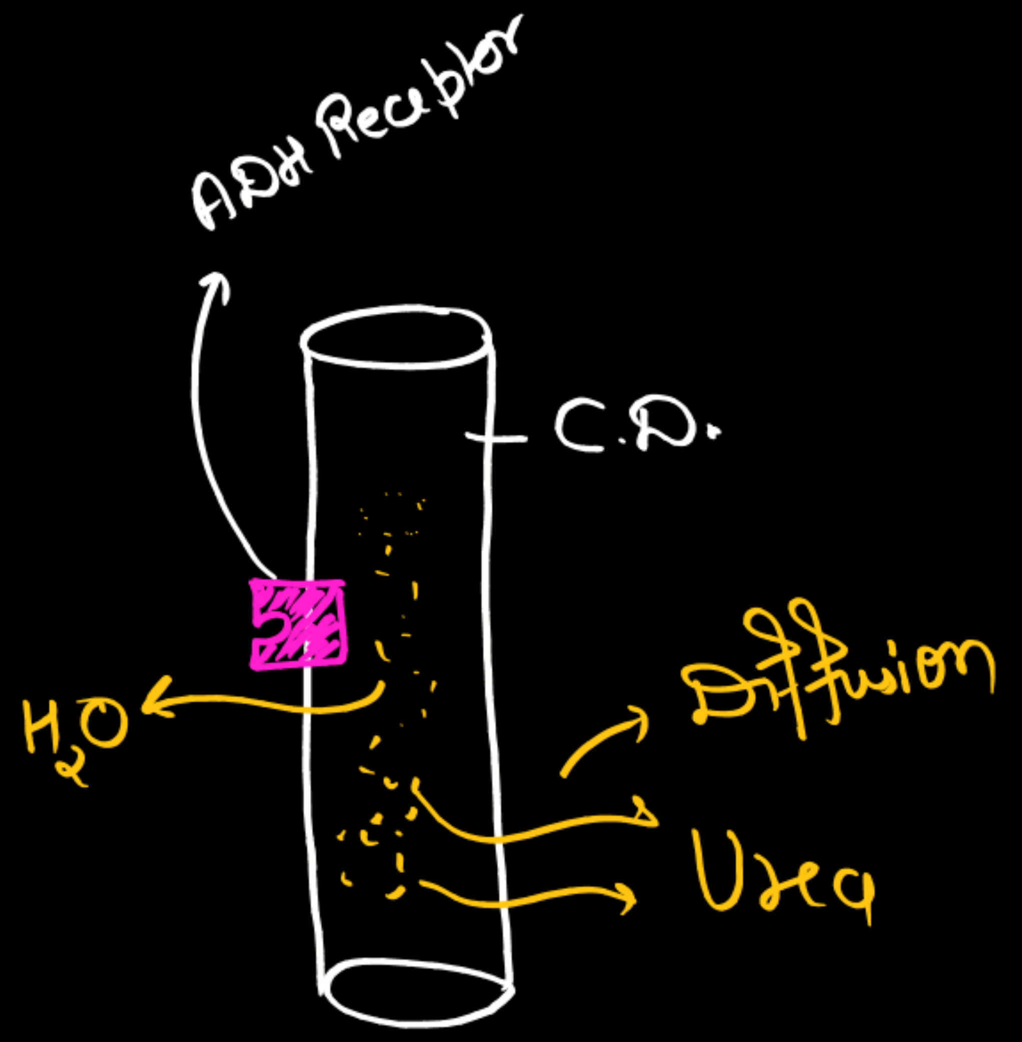
Absorption ↑ of Na^+



(d) Reabsorption from C.D. : < H_2O, urea

- ADH Receptor also prnt in C.D.
- CD also permeable for H_2O
- Small amount of Urea also diffuse through.

CD → Maintain Osmolarity of Kidney Matrix



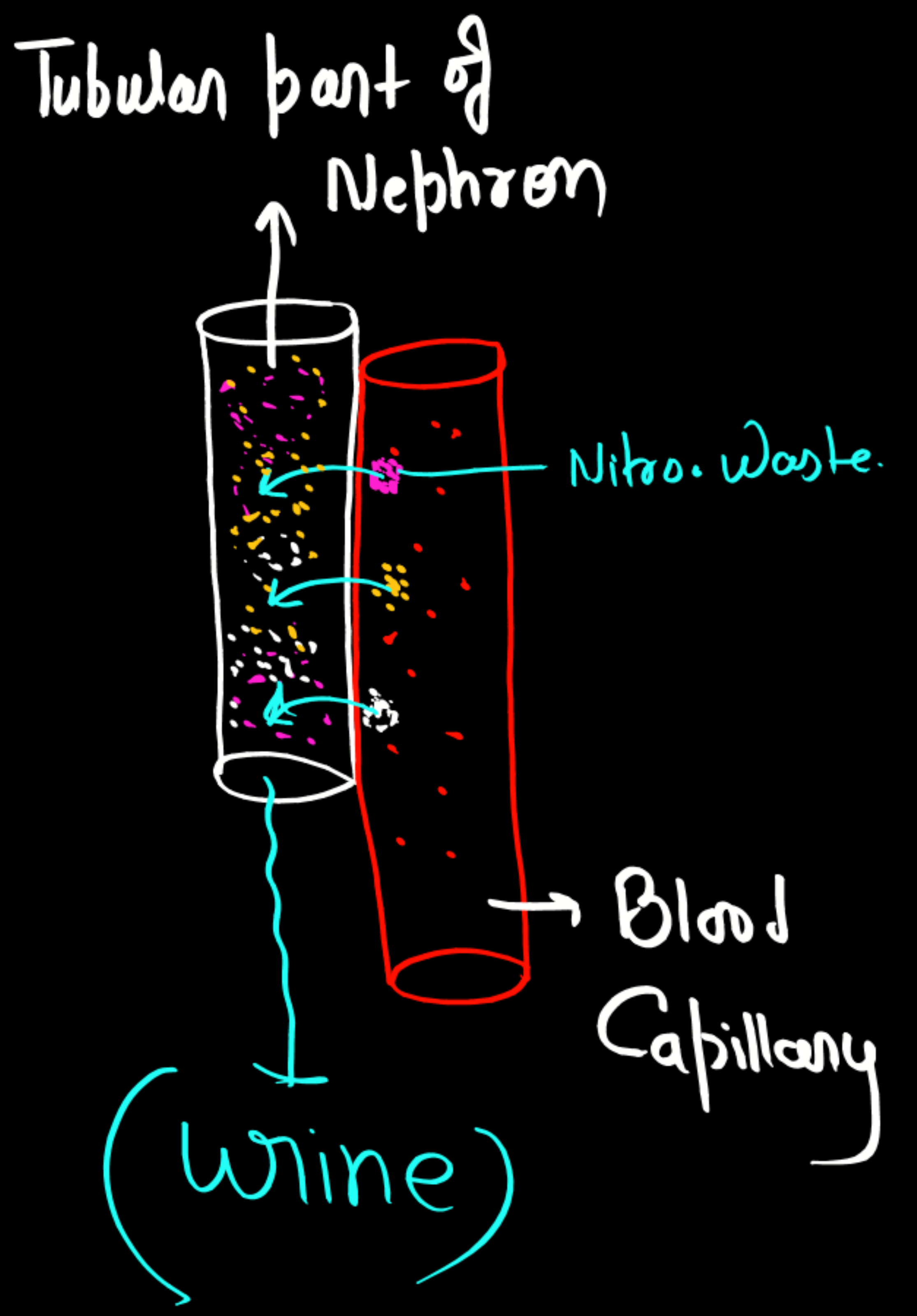
(3) Secretion- (Active Transport) :-

P.C.T. = K^+, H^+, NH_3, Hypuric acid, Toxins, Drugs

L.H. =
- → Descending = X
- → Ascending = urea

DCT = K^+, H^+, NH_3

C.D = K^+ & H^+



16.2 Urine Formation

Urine formation involves three main processes namely, glomerular filtration, reabsorption and secretion, that takes place in different parts of the nephron.

The first step in urine formation is the filtration of blood, which is carried out by the glomerulus and is called **glomerular filtration**. On an average, 1100-1200 ml of blood is filtered by the kidneys per minute which constitute roughly $1/5^{th}$ of the blood pumped out by each ventricle of the heart in a minute. The glomerular capillary blood pressure causes filtration of blood through 3 layers, i.e., the endothelium of glomerular blood vessels, the epithelium of Bowman's capsule and a basement membrane between these two layers. The epithelial cells of Bowman's capsule called podocytes are arranged in an intricate manner so as to leave some minute spaces called filtration slits or slit pores. Blood is filtered so finely through these membranes, that almost all the constituents of the plasma except the proteins pass onto the lumen of the Bowman's capsule. Therefore, it is considered as a process of **ultra filtration.**

The amount of the filtrate formed by the kidneys per minute is called **glomerular filtration rate** (GFR). GFR in a healthy individual is approximately 125 ml/minute, i.e., 180 litres per day !

The kidneys have built-in mechanisms for the regulation of glomerular filtration rate. One such efficient mechanism is carried out by juxta glomerular apparatus (JGA). JGA is a special sensitive region formed by cellular modifications in the distal convoluted tubule and the afferent arteriole at the location of their contact. A fall in GFR can activate the JG cells to release renin which can stimulate the glomerular blood flow and thereby the GFR back to normal.

A comparison of the volume of the filtrate formed per day (180 litres per day) with that of the urine released (1.5 litres), suggest that nearly 99 per cent of the filtrate has to be reabsorbed by the renal tubules. This process is called **reabsorption**. The tubular epithelial cells in different segments of nephron perform this either by active or passive mechanisms. For example, substances like glucose, amino acids, Na^+, etc., in the filtrate are reabsorbed actively whereas the nitrogenous wastes are absorbed by passive transport. Reabsorption of water also occurs passively in the initial segments of the nephron (Figure 16.5).

During urine formation, the tubular cells secrete substances like H^+, K^+ and ammonia into the filtrate. Tubular secretion is also an important step in urine formation as it helps in the maintenance of ionic and acid base balance of body fluids.

1. Urine formation involves-

A) Ultra filtration and reabsorption occurring in different parts of nephron

B) Ultrafiltration and reabsorption occurring in same part of nephron

C) Ultrafiltration, reabsorption and secretion occurring in different parts of nephron

D) Ultrafiltration, reabsorption and secretion occurring in same part of nephron

2. Which of the following statements is correct?

I. Renal vein take blood away from kidney

II. Loop of Henle conserves water

III. Podocytes occur in inner wall of Bowman's capsule

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B) Tubular secretion does not play any significant role in urine formation
C) The amount of urine output per day in normal adult is about 1.5 L
D) During urine formation tubular cells secrete H+, K+ and NH3 in the filtrate

B

H.W

Which substances are actively reabsorbed by nephron?

(A) Glucose, Na+, H+
(B) Nitrogenous wastes, water, K+
(C) Nitrogenous wastes, Amino acid, glucose
(D) Glucose, amino acid, Na+

Which of the following defines the net filtration pressure (NFP)?

(1) BCOP – (GHP + CHP)
(2) GHP – (BCOP + CHP)
(3) (BCOP + GHP) – CHP
(4) (GHP – CHP) + BCOP

Which segment does not play a role in the maintenance of pH and ionic balance of blood by selective secretion?

(A) PCT (B) Henle's loop
(C) DCT (D) Collecting duct

In a healthy person how much amount of blood passes through the kidneys in per minute?

(A) 125 mL (B) 650-700 mL
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Which part of brain sends voluntary motor signals to smooth muscles of urinary bladder for micturition?

(A) Medulla (B) Cerebral cortex
(C) Brain stem (D) Hypothalamus

Thin segment of descending limb of loop of Henle is lined by:

(A) Columnar cells (B) Cuboidal cells
(C) Squamous cells (D) Podocyte cells

Match the items given in column-I with those in column-II and select the correct option given below : (NEET 2018)

Column-I (Function)	Column-II (Part of Excretory System)
(a) Ultrafiltration	(i) Henle's loop
(b) Concentration of urine	(ii) Ureter
(c) Transport of urine	(iii) Urinary bladder
(d) Storage of urine	(iv) Malpighian corpuscle
	(v) Proximal convoluted tubule

	a	b	c	d
(1)	(v)	(iv)	(i)	(ii)
(2)	(iv)	(i)	(ii)	(iii)
(3)	(iv)	(v)	(ii)	(iii)
(4)	(v)	(iv)	(i)	(iii)

Removal of proximal convoluted tubule from the nephron will result in
[AIPMT-2015]

(1) No urine formation
(2) More diluted urine
(3) More concentrated urine
(4) No change in quality and quantity of urine

Which of the following causes an increase in sodium reabsorption in the distal convoluted tubule? [AIPMT-2014]

(1) Increase in aldosterone levels
(2) Increase in antidiuretic hormone levels
(3) Decrease in aldosterone levels
(4) Decrease in antidiuretic hormone levels

The maximum amount of electrolytes and water (70-80 percent) from the glomerular filtrate is reabsorbed in which part of the nephron?
[AIPMT (Prelims)-2012]

(1) Proximal convoluted tubule
(2) Descending limb of loop of Henle
(3) Ascending limb of loop of Henle
(4) Distal convoluted tubule

Which of the following statement is correct?
(NEET 2017)

(1) The descending limb of loop of Henle is impermeable to water.
(2) The ascending limb of loop of Henle is permeableto water
(3) The descending limb, of loop of Henle ispermeable to electrolytes.
(4) The ascending limb to loop of Henle isimpermeable to water

THANK YOU !!

MANTHAN NEET 2025

EXCRETORY PRODUCTS AND THEIR ELIMINATION

LECTURE -5

ZOOLOGY



MD SIR

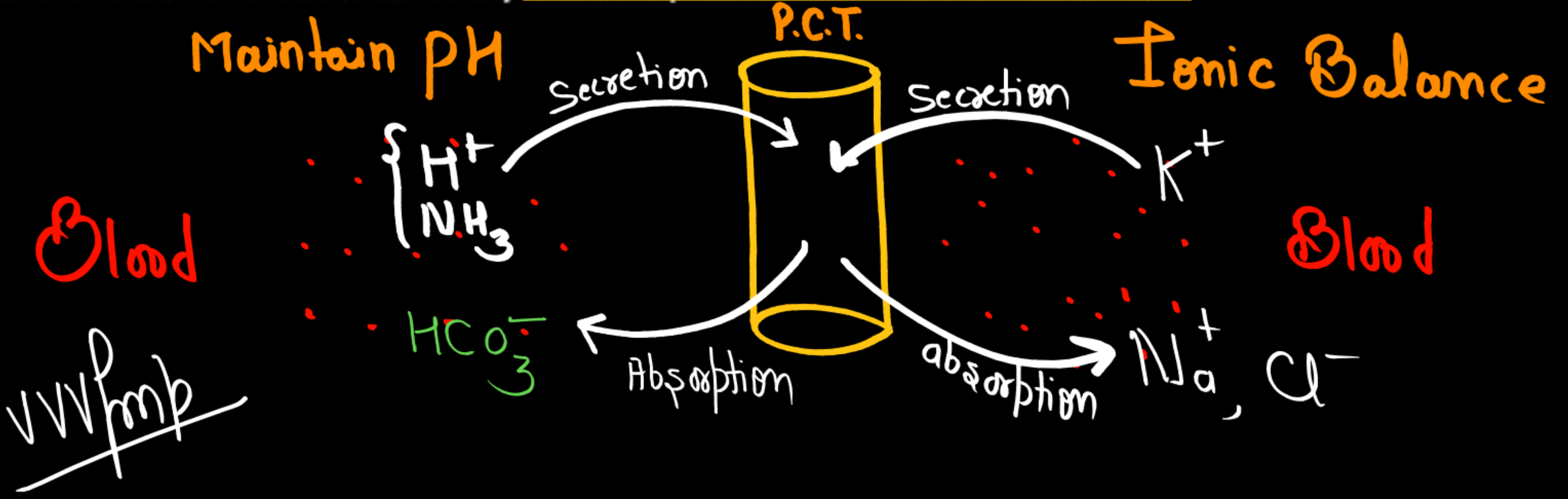
TODAY'S GOAL

- Function of Tubules ✓
- Counter current Mechanism

Function of Tubules

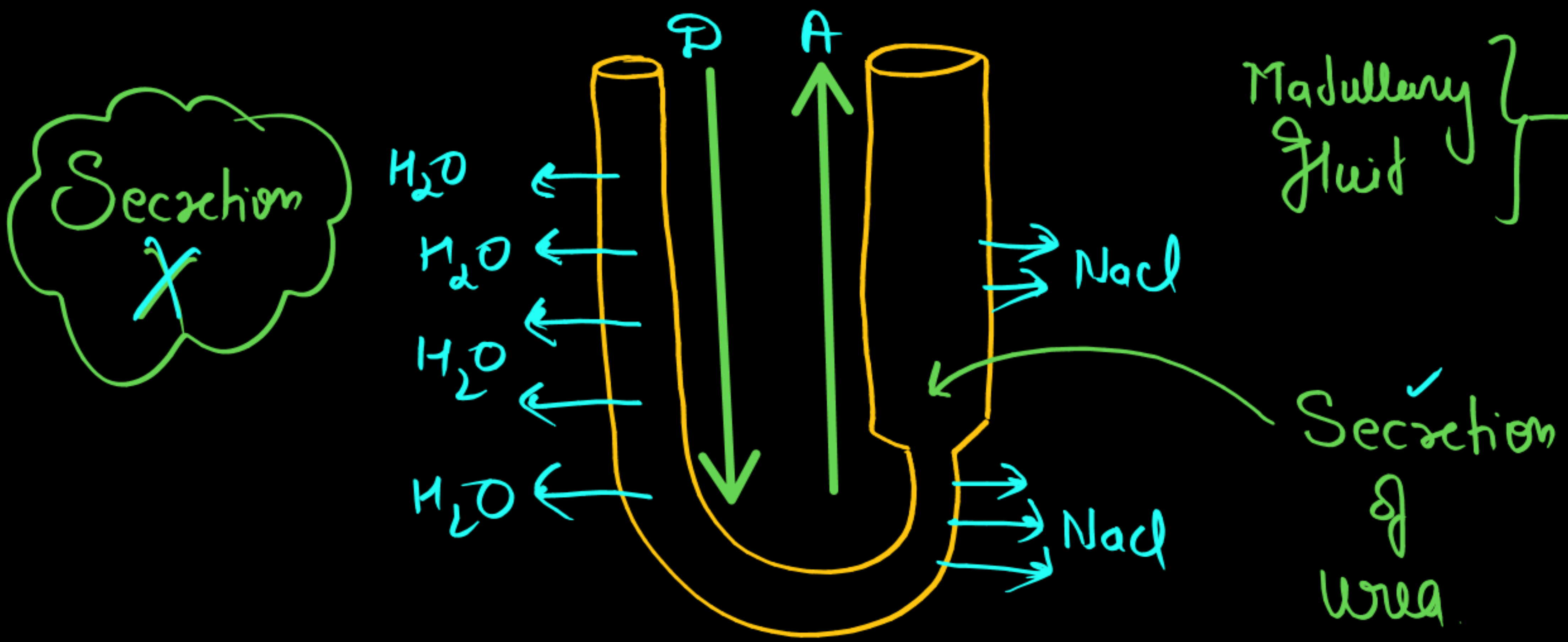
(1) Proximal Convoluted Tubule (PCT):

PCT also helps to maintain the pH and ionic balance of the body fluids by selective secretion of hydrogen ions, ammonia and potassium ions into the filtrate and by absorption of HCO3 from it.



(2) Henle's Loop:

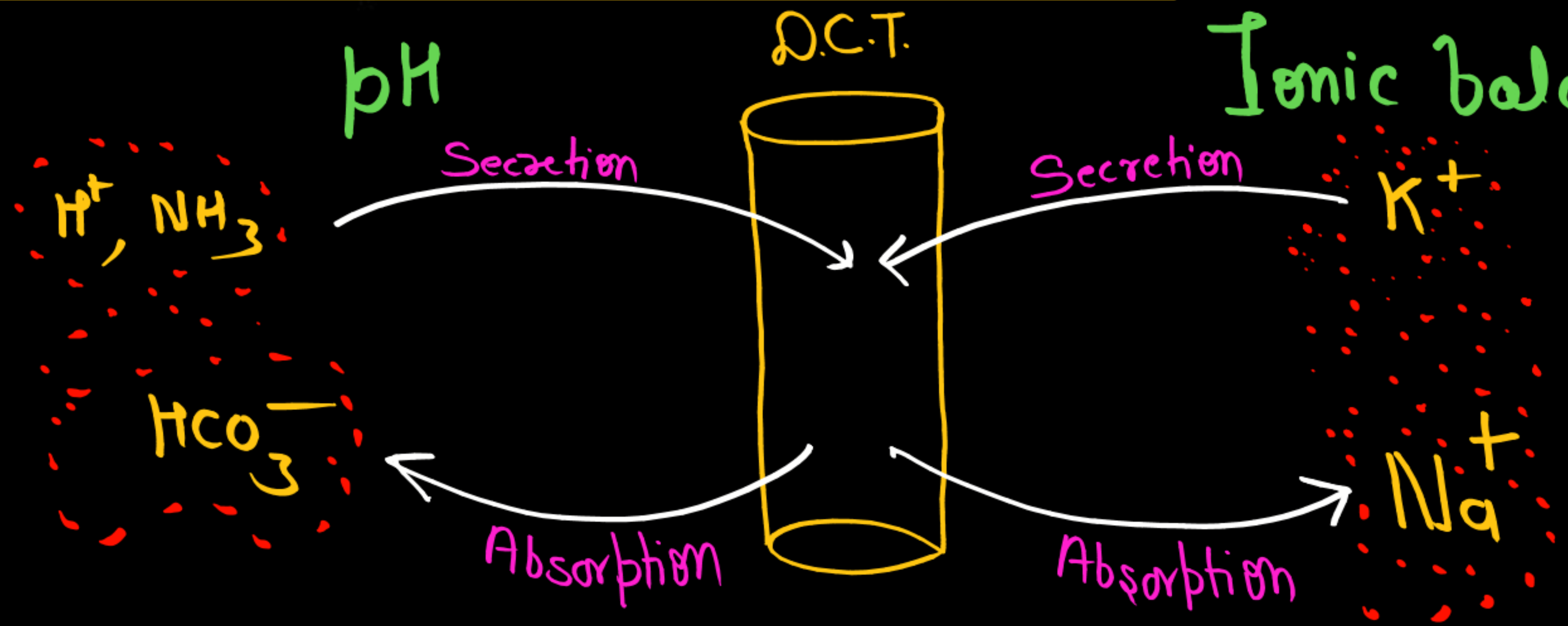
This region plays a significant role in the maintenance of high osmolarity of medullary interstitial fluid. (Not play any rol in maintain < pH, ionic balance.



Medullary fluid } → Osmolarity maintain by — [NaCl, urea

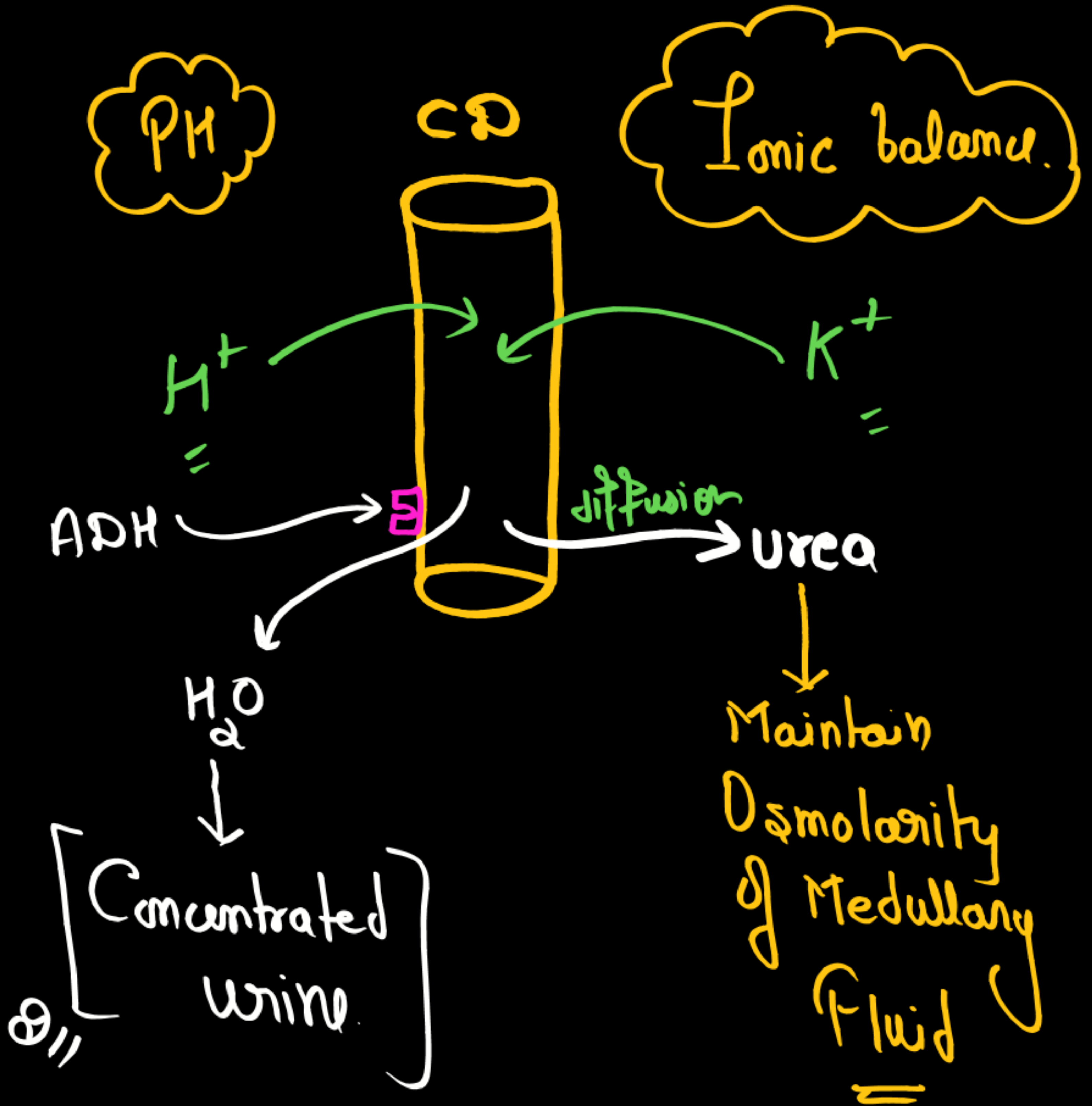
(3) Distal Convoluted Tubule (DCT):

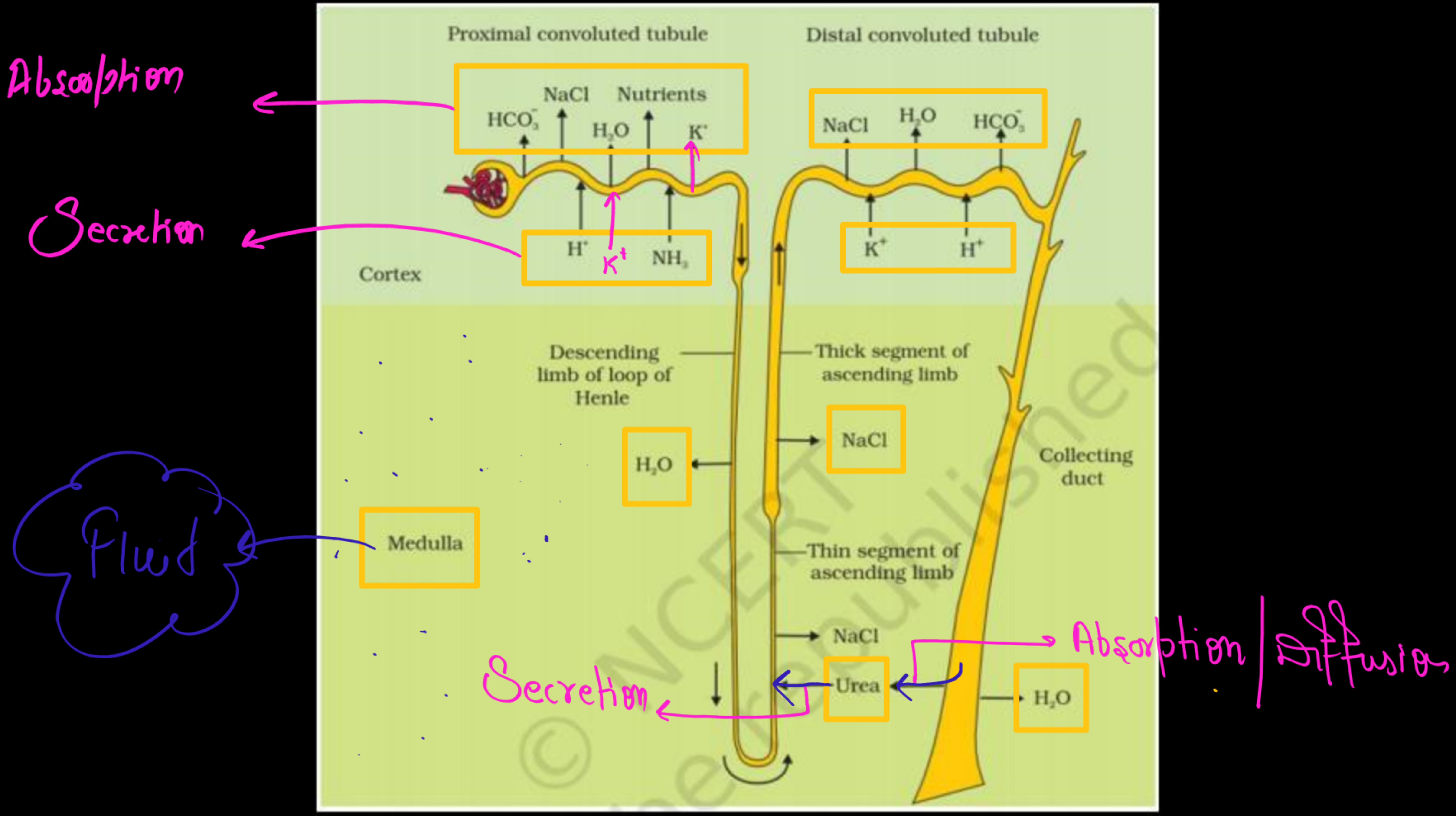
Conditional reabsorption of Na+ and water takes place in this segment. DCT is also capable of reabsorption of HCO3 and selective secretion of hydrogen and potassium ions and NH3 to maintain the pH and sodium-potassium balance in blood.



(4) Collecting Duct:

- Large amounts of water could be reabsorbed from this region to produce a concentrated urine.
- This segment allows passage of small amounts of urea into the medullary interstitium to keep up the osmolarity.
- It also plays a role in the maintenance of pH and ionic balance of blood by the selective secretion of H+ and K+ ions.

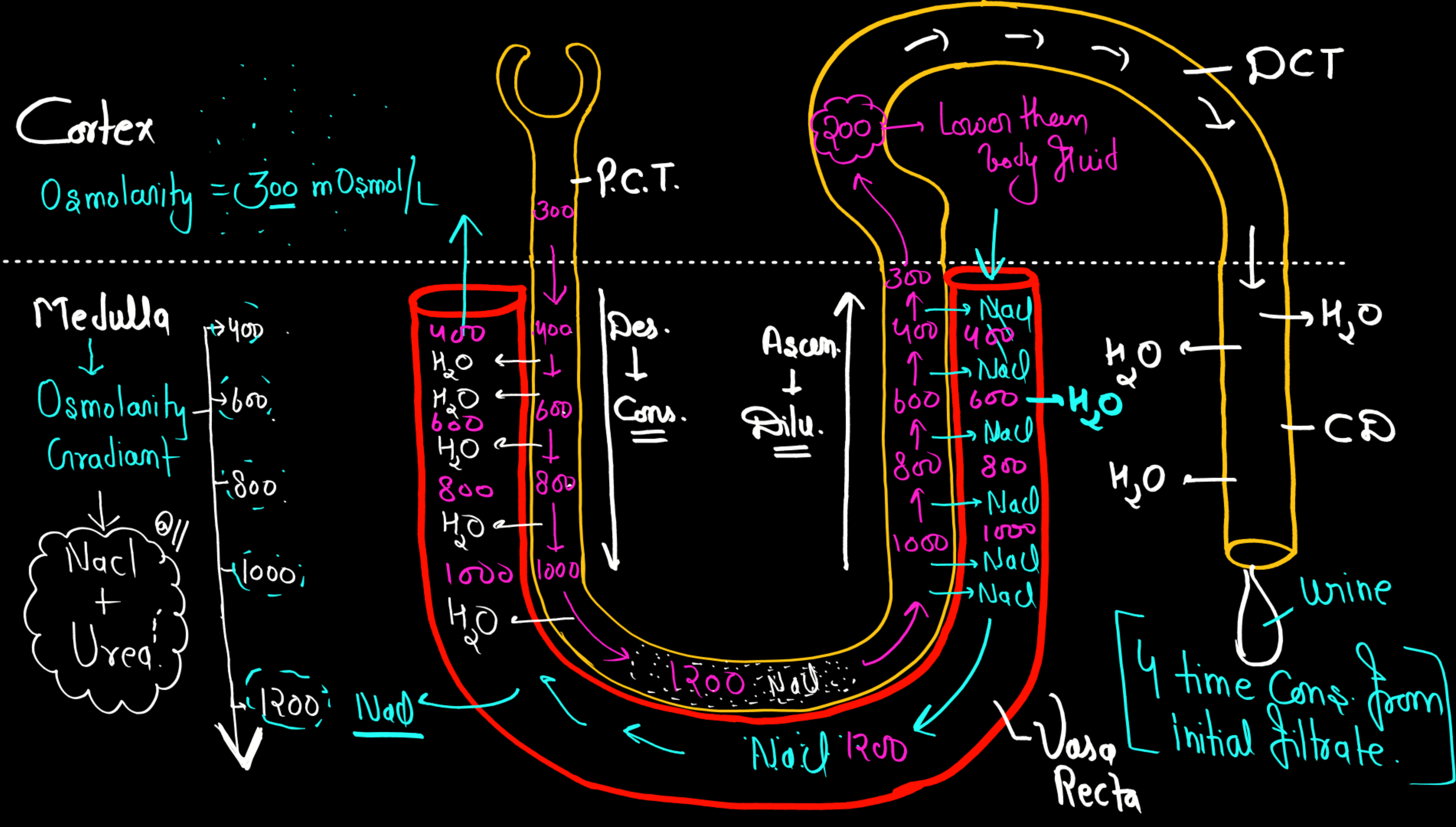




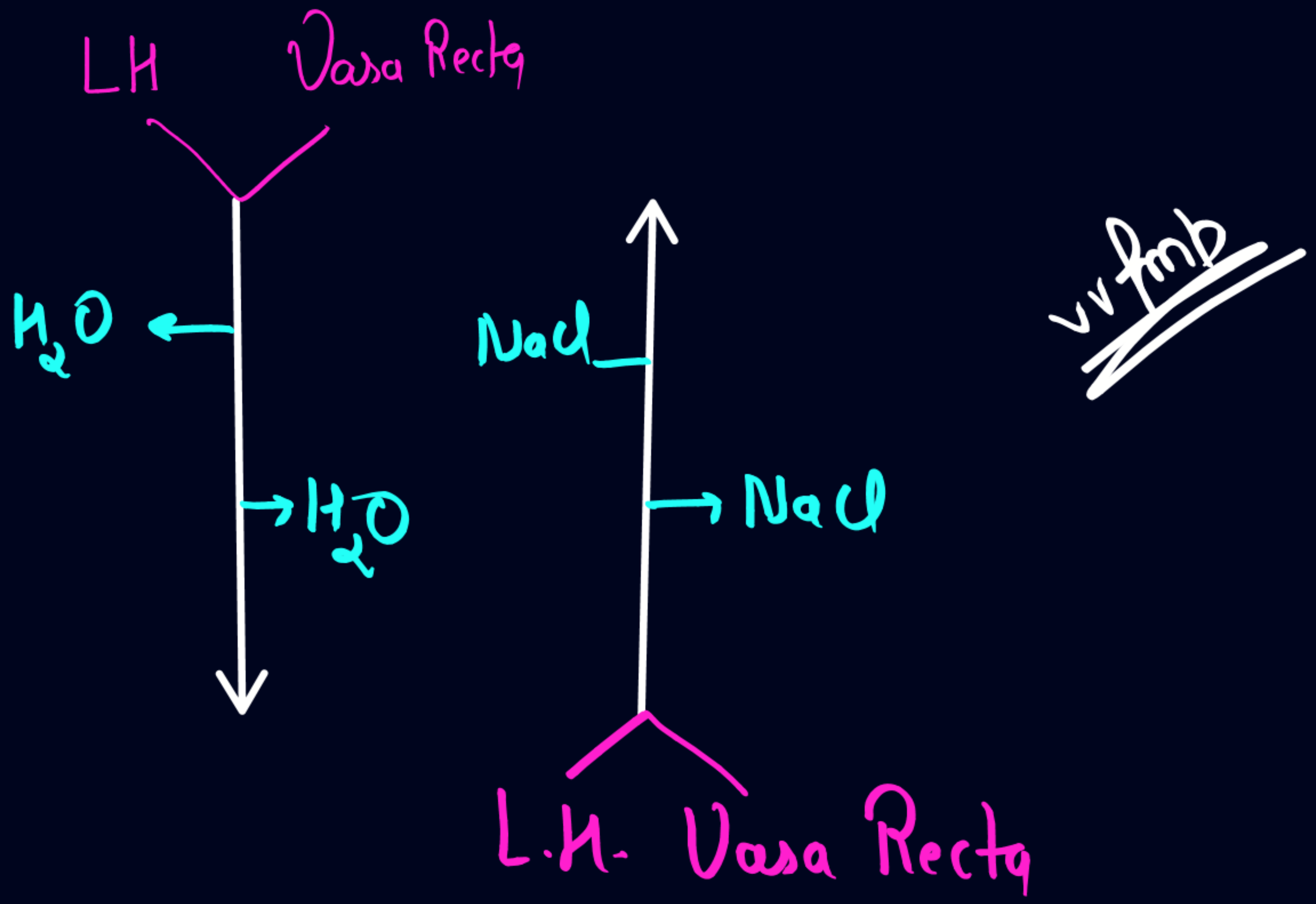
Proximal convoluted tubule
Distal convoluted tubule
HCO_3^-
NaCl
Nutrients
H_2O
K^+
H^+
NH_3
NaCl
H_2O
HCO_3^-
K^+
H^+
Cortex
Descending limb of loop of Henle
Thick segment of ascending limb
H_2O
NaCl
Collecting duct
Medulla
Thin segment of ascending limb
NaCl
Urea
H_2O
Absorption
Secretion
Fluid
Secretion
Absorption / Diffusion

Counter Current Mechanism

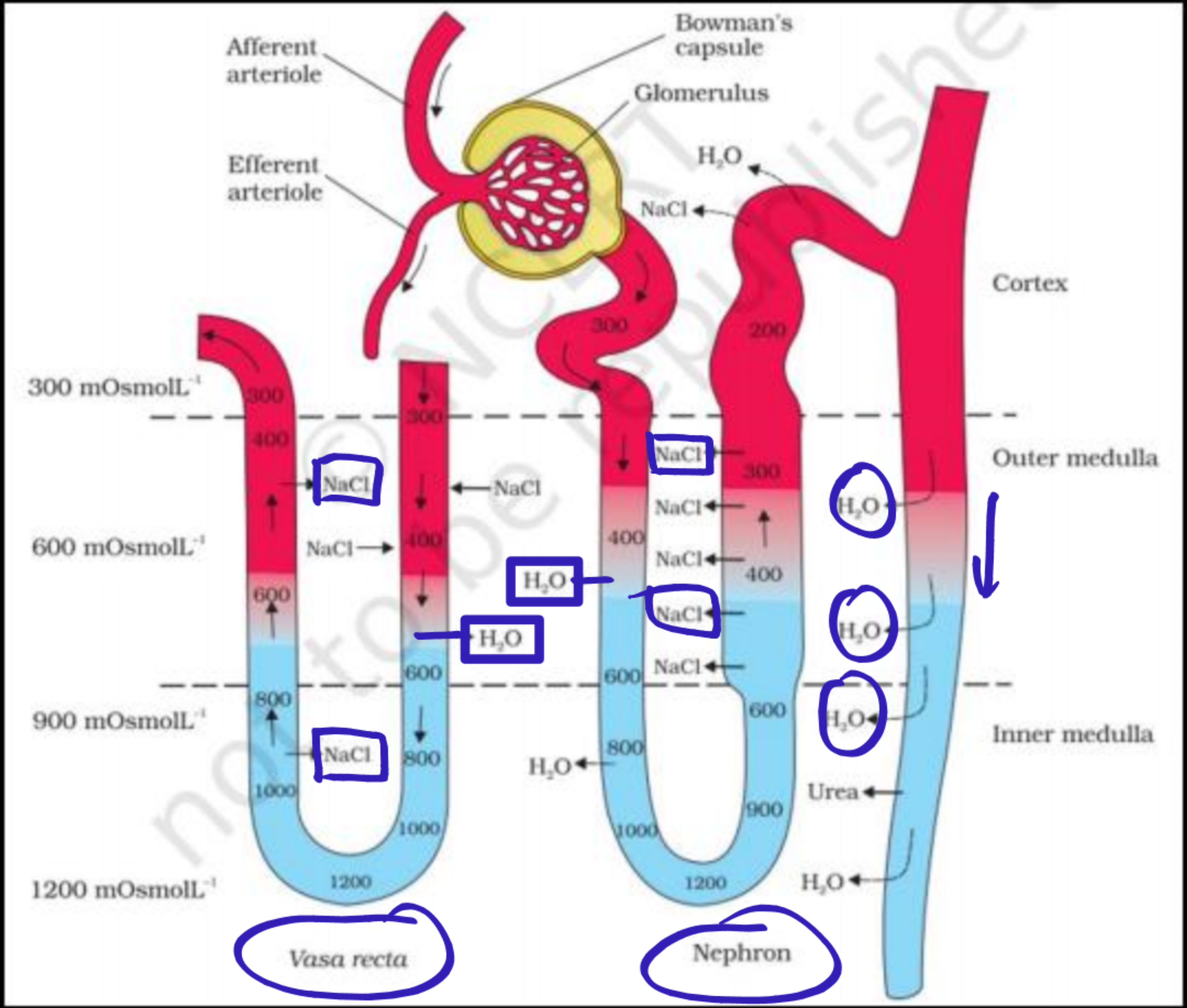
- Mammals have the ability to produce a concentrated urine. The Henle's loop and vasa recta play a significant role in this.
- Osmolarity gradient towards the inner medullary interstitium mainly caused by NaCl and urea.
- Human kidneys can produce urine nearly four times concentrated than the initial filtrate formed.



Cortex
Osmolarity = 300 mOsmol/L
Medulla
Osmolarity Gradiant
Nacl + Urea
400
600
800
1000
1200
NaCl
P.C.T.
Des. Cons.
Ascn. Dilu.
1200 NaCl
NaCl 1200
200
Lower then body fluid
DCT
CD
H2O
Urine
Vasa Recta
4 time Cons. from initial filtrate.



LH
Vasa Recta
H2O
H2O
NaCl
NaCl
L.H. Vasa Recta
vvImp



Afferent arteriole
Efferent arteriole
Bowman's capsule
Glomerulus
Cortex
Outer medulla
Inner medulla
300 mOsmolL⁻¹
600 mOsmolL⁻¹
900 mOsmolL⁻¹
1200 mOsmolL⁻¹
NaCl
H₂O
Urea
300
400
600
800
1000
1200
200
900
Vasa recta
Nephron

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(A) Medulla (B) Cerebral cortex → Voluntary
(C) Brain stem (D) Hypothalamus

Involuntary

Thin segment of descending limb of loop of Henle is lined by:

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(NEET 2018)

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(b) Concentration of urine	(ii) Ureter
(c) Transport of urine	(iii) Urinary bladder
(d) Storage of urine	(iv) Malpighian corpuscle
	(v) Proximal convoluted tubule

	a	b	c	d
(1)	(v)	(iv)	(i)	(ii)
(2)	(iv)	(i)	(ii)	(iii)
(3)	(iv)	(v)	(ii)	(iii)
(4)	(v)	(iv)	(i)	(iii)

Removal of proximal convoluted tubule from the nephron will result in
[AIPMT-2015]

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The maximum amount of electrolytes and water (70-80 percent) from the glomerular filtrate is reabsorbed in which part of the nephron?

[AIPMT (Prelims)-2012]

(1) Proximal convoluted tubule — 70-80%

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(3) Ascending limb of loop of Henle

(4) Distal convoluted tubule

Which of the following statement is correct?
(NEET 2017)

(1) The descending limb of loop of Henle is impermeable to water. X

(2) The ascending limb of loop of Henle is permeableto water X

(3) The descending limb, of loop of Henle ispermeable to electrolytes. X

(4) The ascending limb to loop of Henle isimpermeable to water ✓

(4)

THANK YOU !!

MANTHAN NEET 2025

EXCRETORY PRODUCTS AND THEIR ELIMINATION

LECTURE -6

ZOOLOGY



MD SIR

TODAY'S GOAL

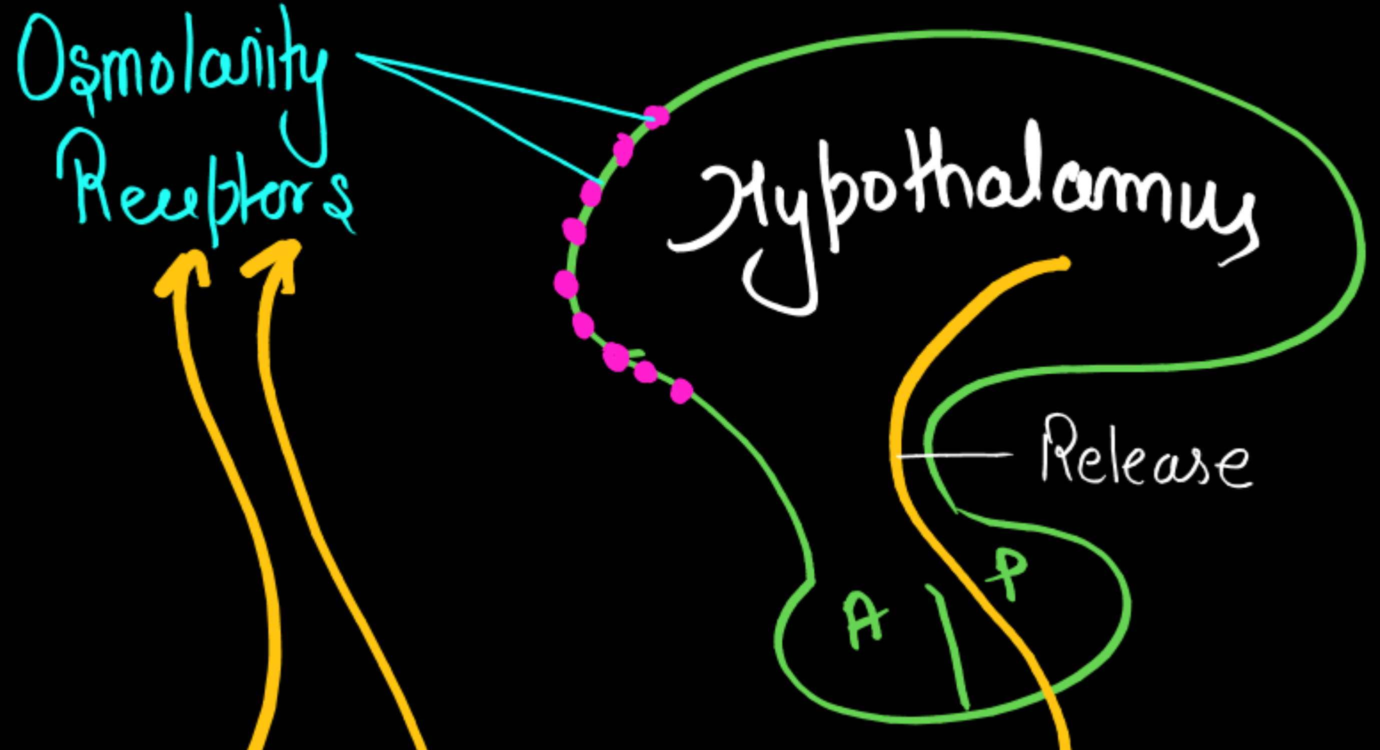
- Regulation of Kidney Function ✓ vvImp
- DISORDERS OF THE EXCRETORY SYSTEM

Regulation of Kidney Function

(1) Regulation By Hypothalamus

if = Body fluid
or
G.F.R
or
Blood Volume
or
B.P. } ↓

Volume of urine
or
Osmolarity of body fluid } ↑



ADH (Vasopressin)

↓

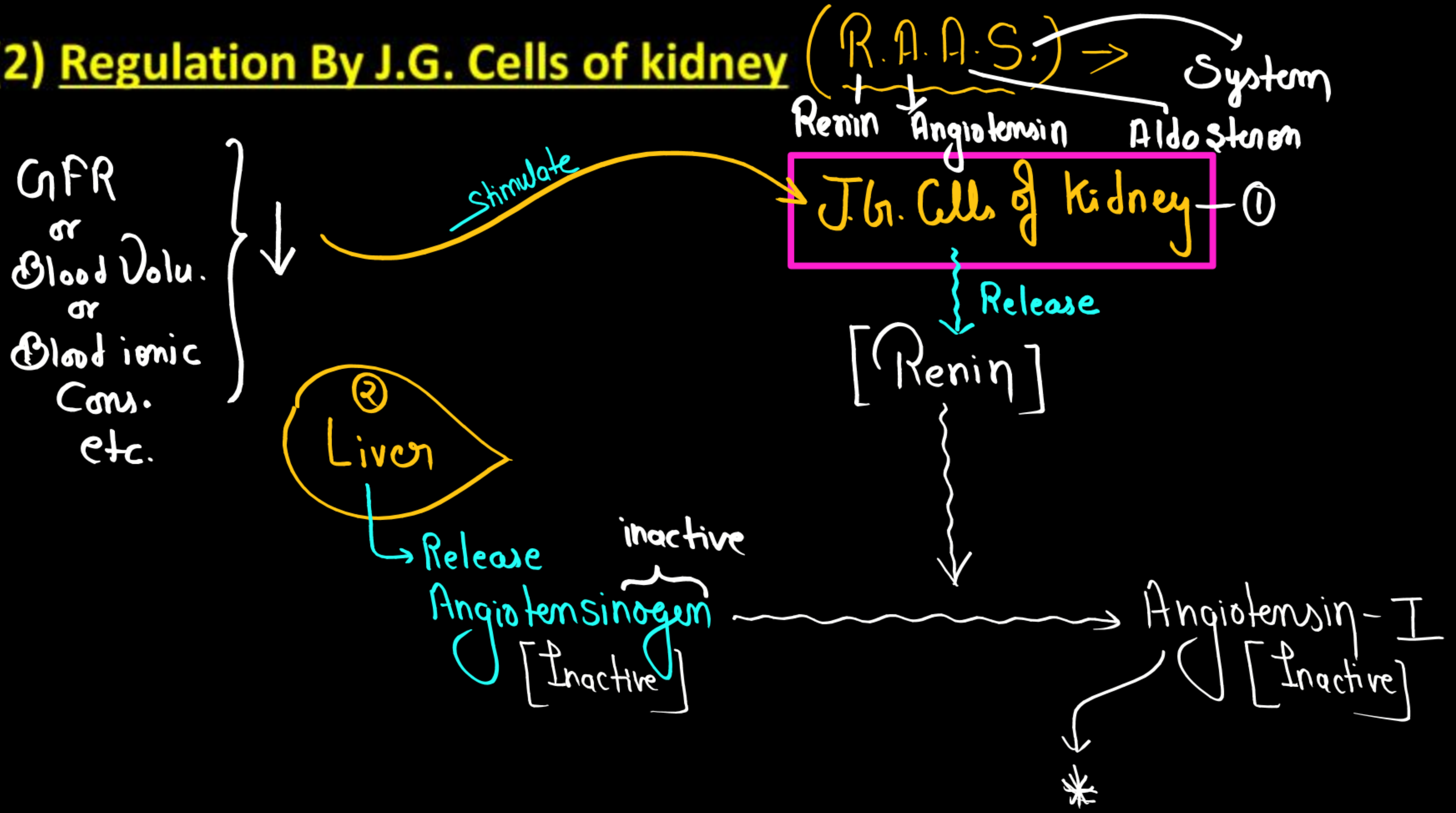
[↑ absorption of Water from = DCT & CD]

⇓

GFR, Osmolarity, Blood Volu. etc. Normal

⇒ [Stop Secretion of ADH]

(2) Regulation By J.G. Cells of kidney



*

Angiotensin-I → (A.C.E. — Angiotensin Converting Enzyme) → Angiotensin-II [Active form]



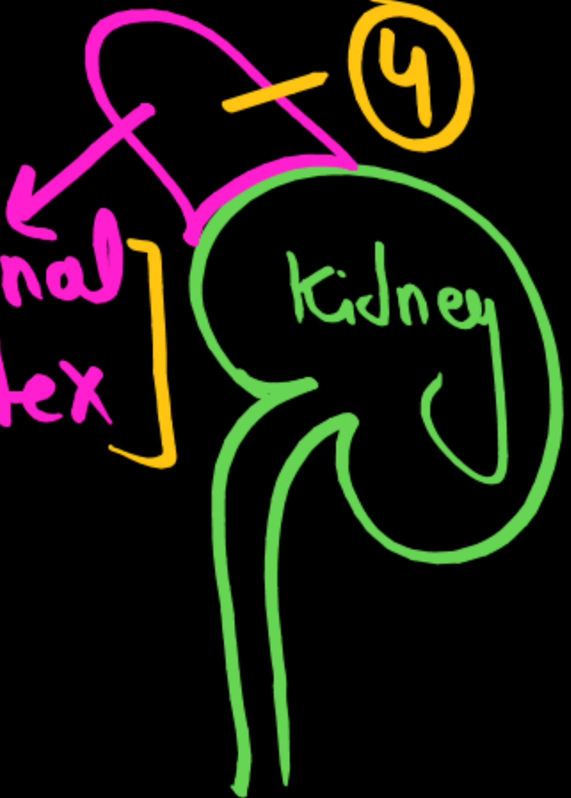
Angiotensin-II [Active form]

↓

i) - Powerful Vasoconstrictor = ↑ - B.P & GFR

ii) - ↑ absorption of Na^+ & Water from P.C.T.

iii) - Stimulate → [Adrenal Cortex] → Release → [Aldosteron]



[Aldosteron] → ↑ - absorption of - Na^+ & Water from D.C.T.

⇓

GFR, Ionic Conc, B.P etc

⇓

Normal

(3) Atrial Natriuretic Factor (ANF) = Antagonistic of R.A.A.S.

if - R.A.A.S. = Hyper = B.P. = ↑ → **Wall of Atria** (imp)

↓ Release

[A.N.F.]

1) - Vasodilator → B.P. = ↓

2) - Inhibit → R.A.A.S.

3) → Act as → Diuretic (More urine)

Role of Other Organ in Excretion

Other than the kidneys, lungs, liver and skin also help in the elimination of excretory wastes.

Our lungs remove large amounts of CO_2 (approximately 200mL/ minute) and also significant quantities of water every day. Liver, the largest gland in our body, secretes bile-containing substances like bilirubin, biliverdin, cholesterol, degraded steroid hormones, vitamins and drugs. Most of these substances ultimately pass out alongwith digestive wastes.

The sweat and sebaceous glands in the skin can eliminate certain substances through their secretions. Sweat produced by the sweat glands is a watery fluid containing NaCl, small amounts of urea, lactic acid, etc. Though the primary function of sweat is to facilitate a cooling effect on the body surface, it also helps in the removal of some of the wastes mentioned above. Sebaceous glands eliminate certain substances like sterols, hydrocarbons and waxes through sebum. This secretion provides a protective oily covering for the skin. Do you know that small amounts of nitrogenous wastes could be eliminated through saliva too?

4- Organs

Lungs = Co_2 (200 mL/min.)

Liver = Bile → Bilirubin, Biliverdin, Cholesterol, Steroid Hormones

Skin → oil gland

Sweat: NaCl, urea, lactic acid,

Sebaceous glands: Sterols, Hydrocarbons, waxes

Urine

- An adult human excretes, on an average, 1 to 1.5 liters of urine per day.
- The urine formed is a light yellow coloured watery fluid which is slightly acidic (pH-6.0) and has a characteristic odor.
- On an average, 25-30 gm of urea is excreted out per day.

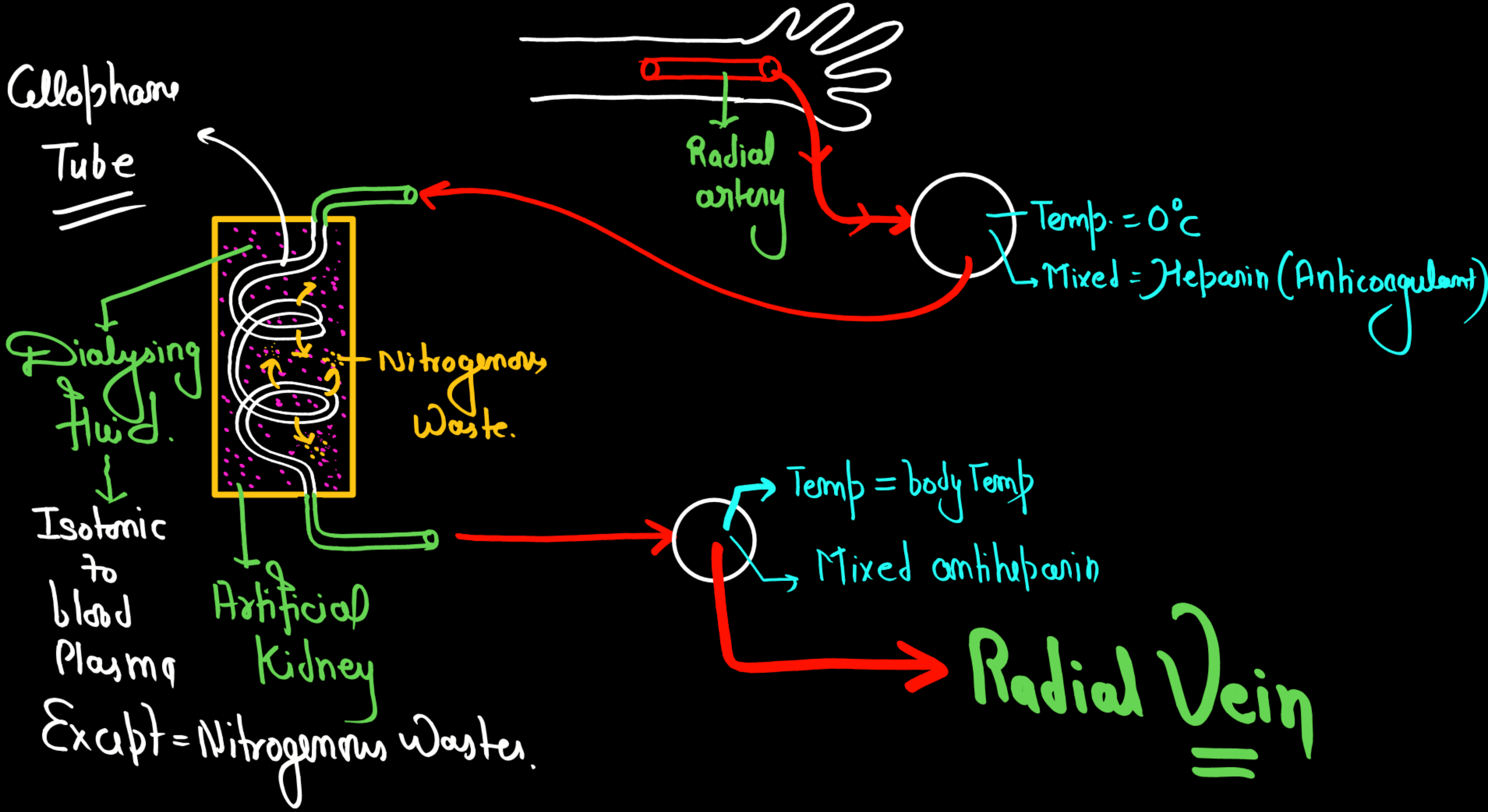
* 25-30 gm urea / day

DISORDERS OF THE EXCRETORY SYSTEM

- Malfunctioning of kidneys can lead to accumulation of urea in blood, a condition called uremia, which is highly harmful and may lead to kidney failure. In such patients, urea can be removed by a process called hemodialysis. During the process of haemodialysis, the blood drained from a convenient artery is pumped into a dialysing unit called artificial kidney.

* uremia → ↑ Conc. of urea in blood.

urea | Blood


Cellophane Tube
Radial artery
Temp. = 0°c
Mixed = Heparin (Anticoagulant)
Dialysing fluid.
Nitrogenous Waste.
Isotonic to blood Plasma
Except = Nitrogenous Wastes.
Artificial Kidney
Temp = body Temp
Mixed antiheparin
Radial Vein

- Glycosuria → Presence of glucose in urine.
- Ketonuria → Presence of ketone bodies in urine
- Renal calculi: - Stone or insoluble mass of crystallized salts (oxalates, etc.) formed within the kidney.
- Glomerulonephritis: - Inflammation of glomeruli of kidney

Diabetes Mellitus

16.3 Function of the Tubules

Proximal Convoluted Tubule (PCT): PCT is lined by simple cuboidal brush border epithelium which increases the surface area for reabsorption. Nearly all of the essential nutrients, and 70-80 per cent of electrolytes and water are reabsorbed by this segment. PCT also helps to maintain the pH and ionic balance of the body fluids by selective secretion of hydrogen ions and ammonia into the filtrate and by absorption of HCO_3^- from it.

Henle's Loop: Reabsorption is minimum in its ascending limb. However, this region plays a significant role in the maintenance of high osmolarity of medullary interstitial fluid. The descending limb of loop of Henle is permeable to water but almost impermeable to electrolytes. This concentrates the filtrate as it moves down. The ascending limb is impermeable to water but allows transport of electrolytes actively or passively. Therefore, as the concentrated filtrate pass upward, it gets diluted due to the passage of electrolytes to the medullary fluid.

Distal Convoluted Tubule (DCT): Conditional reabsorption of Na^+ and water takes place in this segment. DCT is also capable of reabsorption of HCO_3^- and selective secretion of hydrogen and potassium ions and NH_3 to maintain the pH and sodium-potassium balance in blood.

Collecting Duct: This long duct extends from the cortex of the kidney to the inner parts of the medulla. Large amounts of water could be reabsorbed from this region to produce a concentrated urine. This segment allows passage of small amounts of urea into the medullary interstitium to keep up the osmolarity. It also plays a role in the maintenance of pH and ionic balance of blood by the selective secretion of H^+ and K^+ ions (Figure 16.5).

16.4 Mechanism of Concentration of the Filtrate

Mammals have the ability to produce a concentrated urine. The Henle's loop and *vasa recta* play a significant role in this. The flow of filtrate in the two limbs of Henle's loop is in opposite directions and thus forms a counter current. The flow of blood through the two limbs of *vasa recta* is

also in a counter current pattern. The proximity between the Henle's loop and *vasa recta*, as well as the counter current in them help in maintaining an increasing osmolarity towards the inner medullary interstitium, i.e., from 300 $mOsmolL^{-1}$ in the cortex to about 1200 $mOsmolL^{-1}$ in the inner medulla. This gradient is mainly caused by NaCl and urea. NaCl is transported by the ascending limb of Henle's loop which is exchanged with the descending limb of *vasa recta*. NaCl is returned to the interstitium by the ascending portion of *vasa recta*. Similarly, small amounts of urea enter the thin segment of the ascending limb of Henle's loop which is transported back to the interstitium by the collecting tubule. The above described transport of substances facilitated by the special arrangement of Henle's loop and *vasa recta* is called the **counter current mechanism** (Figure. 16.6). This mechanism helps to maintain a concentration gradient in the medullary interstitium. Presence of such interstitial gradient helps in an easy passage of water from the collecting tubule thereby concentrating the filtrate (urine). Human kidneys can produce urine nearly four times concentrated than the initial filtrate formed.

16.5 Regulation of Kidney Function

The functioning of the kidneys is efficiently monitored and regulated by hormonal feedback mechanisms involving the hypothalamus, JGA and to a certain extent, the heart.

Osmoreceptors in the body are activated by changes in blood volume, body fluid volume and ionic concentration. An excessive loss of fluid from the body can activate these receptors which stimulate the hypothalamus to release antidiuretic hormone (ADH) or vasopressin from the neurohypophysis. ADH facilitates water reabsorption from latter parts of the tubule, thereby preventing diuresis. An increase in body fluid volume can switch off the osmoreceptors and suppress the ADH release to complete the feedback. ADH can also affect the kidney function by its constrictory effects on blood vessels. This causes an increase in blood pressure. An increase in blood pressure can increase the glomerular blood flow and thereby the GFR.

The JGA plays a complex regulatory role. A fall in glomerular blood flow/glomerular blood pressure/GFR can activate the JG cells to release **renin** which converts angiotensinogen in blood to angiotensin I and further to angiotensin II. Angiotensin II, being a powerful vasoconstrictor, increases the glomerular blood pressure and thereby GFR. Angiotensin II also activates the adrenal cortex to release Aldosterone. Aldosterone causes reabsorption of Na^+ and water from the distal parts of the tubule. This also leads to an increase in blood pressure and GFR. This complex mechanism is generally known as the **Renin-Angiotensin** mechanism.

An increase in blood flow to the atria of the heart can cause the release of **Atrial Natriuretic Factor** (ANF). ANF can cause vasodilation (dilation of blood vessels) and thereby decrease the blood pressure. ANF mechanism, therefore, acts as a check on the renin-angiotensin mechanism.

ANF is secreted by :

(A) Heart
(B) Kidney
(C) Neurohypophysis
(D) Adrenal gland

Which one of the following is not normally excreted in urine?

(A) Hippuric acid (B) Uric acid
(C) Ketone bodies (D) Amino acid

ADH can increases:

(a) Glomerular blood flow

(b) Urine volume

(c) Blood pressure

(d) Body fluid volume

(e) Blood osmolarity

(f) GFR

Options:

(A) a, b, c, d, e (B) a, b, c, e, f

(C) a, c, d, f (D) c, d, e, f

In case of dehydration, secretion of which hormone is not increased?

(A) ANF (B) Renin
(C) ADH (D) Aldosterone

In which the following favour for the formation of dilute urine:

(A) ADH (B) Aldosterone
(C) ANF (D) Renin

Inflammation of glomeruli of kidney is :

(A) Renal calculi

(B) Glomerulo nephritis

(C) Renal failures

(D) Uremia

THANK YOU !!

MANTHAN NEET 2025

LOCOMOTION AND MOVEMENT

LECTURE - 1

ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

- ❑ Locomotion
- ❑ Structure of Skeletal Muscle

Locomotion

Types of movement

1. Amoeboid
2. Ciliary
3. Muscular

Amoeba → Streaming Movement of Protoplasm



Pseudopodia → Locomotion

Protoplasm

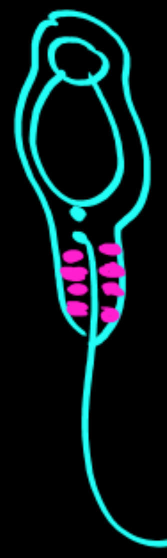
Microfilament [Cytoskeleton]

eg → W.B.C
→ Macrophase
} Amoeboidal Movement

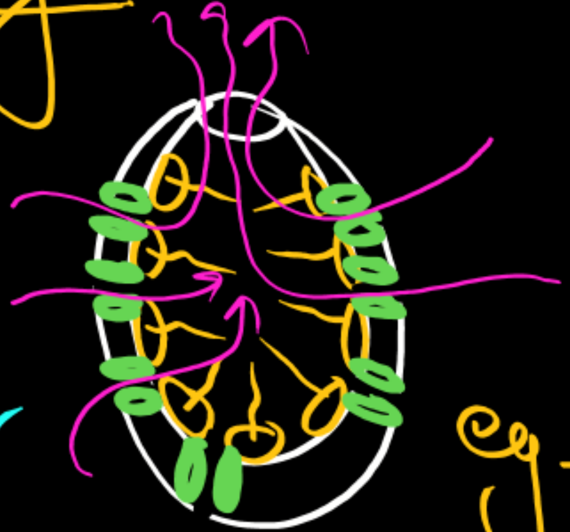
1) - Jaw
2) - Eye
3) - Limbs
4) - Tongue

Tentacles — Hydra

Flagellum

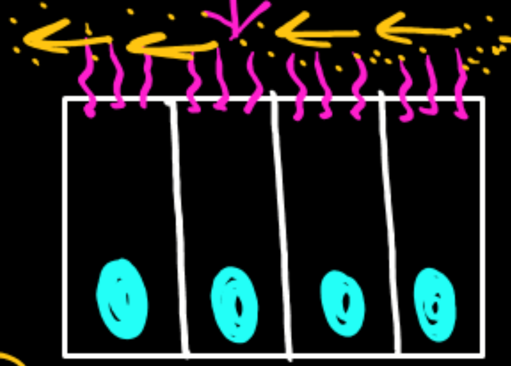


Sperm



Sponge

Cilia



eg - Respiratory Tract
→ Fallopian Tube

Displacement of Mucus

Some of the movements result in a change of place or location. Such voluntary movements are called **locomotion.**

- All locomotions are movements but all movements are not locomotions.
- Methods of locomotion performed by animals vary with their habitats and the demand of the situation.



Muscles

- Muscle is a specialized tissue of mesodermal origin.
- No. of muscles → 639 Total No. of Muscles
  - → 317 = Paired
  - → 5 = unpaired
- Which form about 40-50 per cent of the body weight of a human adult.

Property of Muscles –

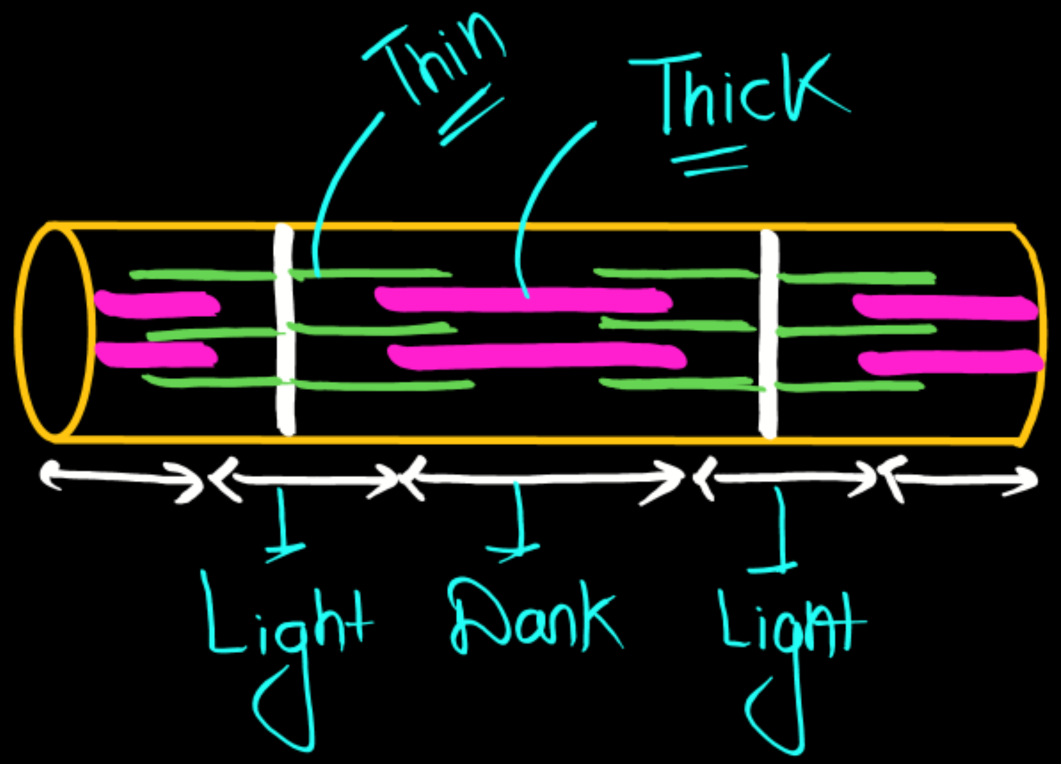
1. Excitability (like - Nerve Cells)
2. Contractility
3. Extensibility
4. Elasticity.

Insulin Receptors prt on
- Skeletal Muscles
- Hepatocytes.

Skeletal Muscles

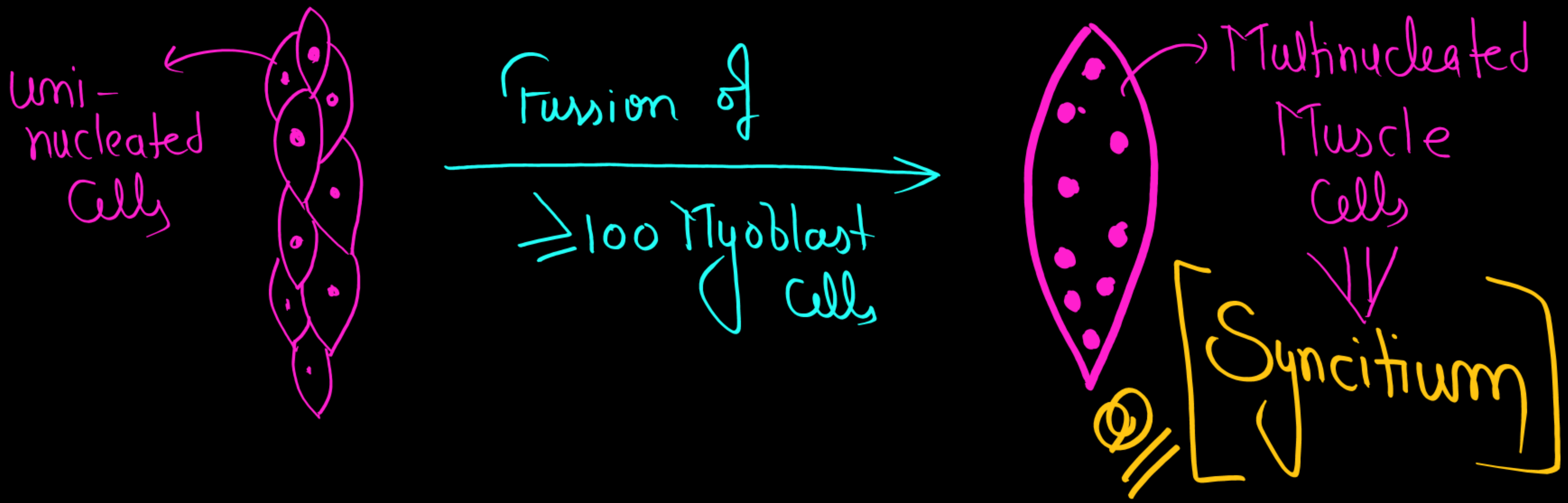
- → Voluntary
- → Striated = Light & Dark Bands.
- → Striped = → Transversed bands.
- → Multinucleated

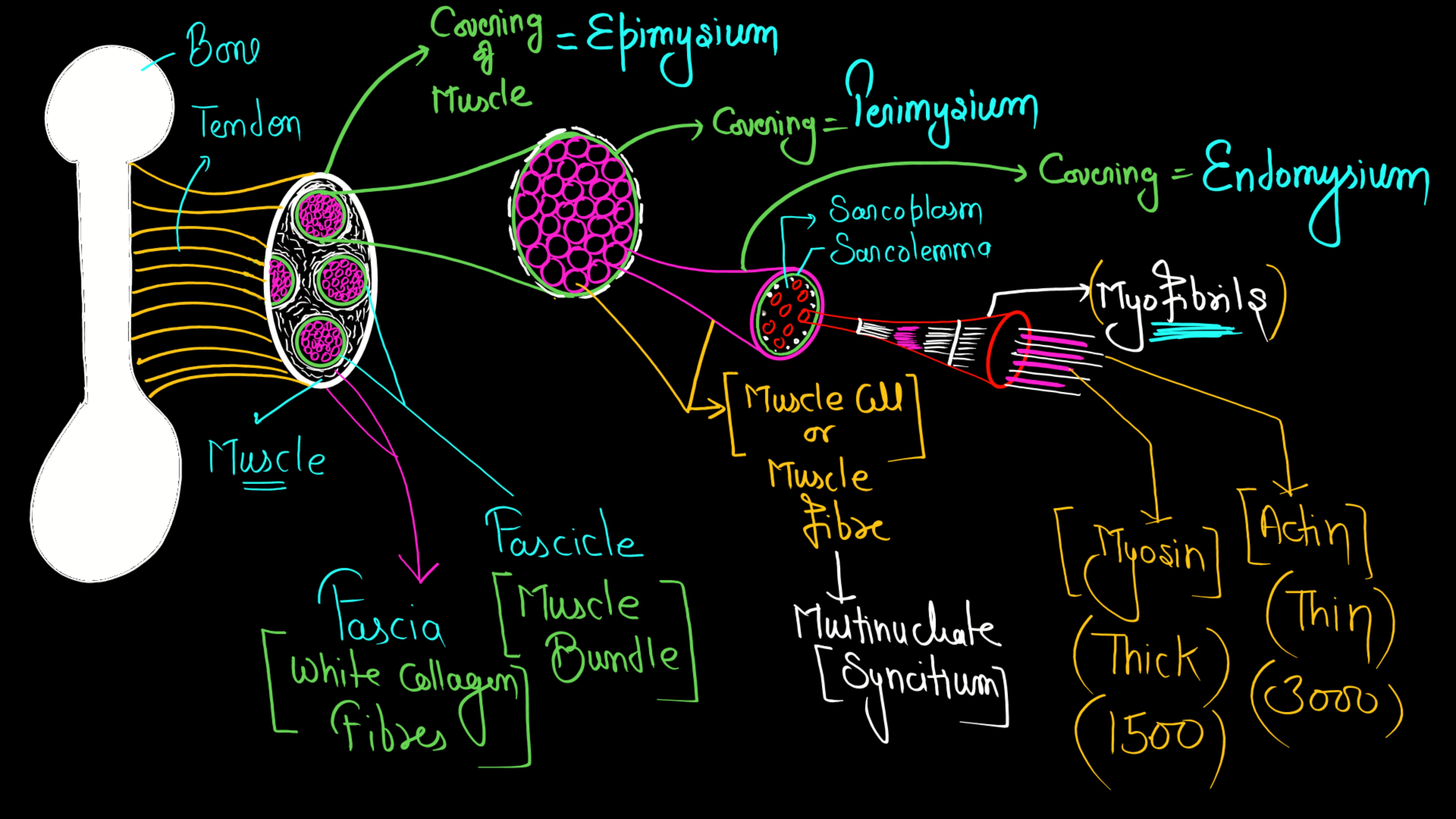
Multinucleated → Syncitium



Syncitium (Multinucleated) →

In skeletal Muscles Each Muscles fibre form by fussion of ≥100 myoblast cells.





Bone
Tendon
Muscle
Covering of Muscle = Epimysium
Covering = Perimysium
Covering = Endomysium
Sarcoplasm
Sarcolemma
Myofibrils
Muscle Cell or Muscle Fibre
Multinucleate [Syncitium]
Fascia [White Collagen Fibres]
Fascicle [Muscle Bundle]
[Myosin] (Thick) (1500)
[Actin] (Thin) (3000)

Movement is one of the significant features of living beings. Animals and plants exhibit a wide range of movements. Streaming of protoplasm in the unicellular organisms like *Amoeba* is a simple form of movement. Movement of cilia, flagella and tentacles are shown by many organisms. Human beings can move limbs, jaws, eyelids, tongue, etc. Some of the movements result in a change of place or location. Such voluntary movements are called **locomotion**. Walking, running, climbing, flying, swimming are all some forms of locomotory movements. Locomotory structures need not be different from those affecting other types of movements. For example, in *Paramoecium*, cilia helps in the movement of food through cytopharynx and in locomotion as well. *Hydra* can use its tentacles for capturing its prey and also use them for locomotion. We use limbs for changes in body postures and locomotion as well. The above observations suggest that movements and locomotion cannot be studied separately. The two may be linked by stating that all locomotions are movements but all movements are not locomotions.

Methods of locomotion performed by animals vary with their habitats and the demand of the situation. However, locomotion is generally for search of food, shelter, mate, suitable breeding grounds, favourable climatic conditions or to escape from enemies/predators.

Some specialised cells in our body like macrophages and leucocytes in blood exhibit amoeboid movement. It is effected by pseudopodia formed by the streaming of protoplasm (as in *Amoeba*). Cytoskeletal elements like microfilaments are also involved in amoeboid movement.

Ciliary movement occurs in most of our internal tubular organs which are lined by ciliated epithelium. The coordinated movements of cilia in the trachea help us in removing dust particles and some of the foreign substances inhaled alongwith the atmospheric air. Passage of ova through the female reproductive tract is also facilitated by the ciliary movement.

Movement of our limbs, jaws, tongue, etc, require muscular movement. The contractile property of muscles are effectively used for locomotion and other movements by human beings and majority of multicellular organisms. Locomotion requires a perfect coordinated activity of muscular, skeletal and neural systems. In this chapter, you will learn about the types of muscles, their structure, mechanism of their contraction and important aspects of the skeletal system.

20.2 Muscle

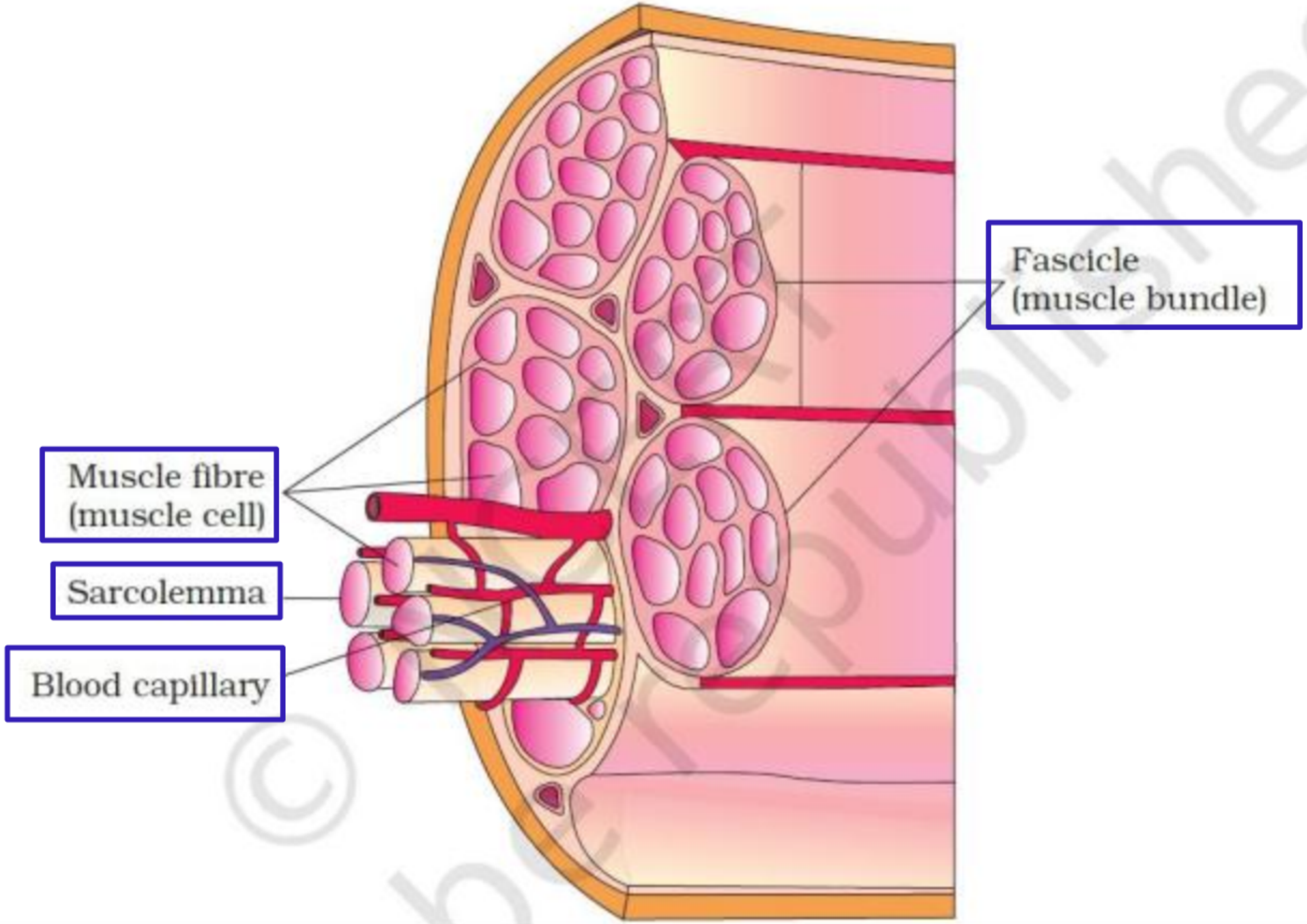
You have studied in Chapter 8 that the cilia and flagella are the outgrowths of the cell membrane. **Flagellar movement** helps in the swimming of spermatozoa, maintenance of water current in the canal system of sponges and in locomotion of Protozoans like *Euglena*. Muscle is a specialised tissue of mesodermal origin. About 40-50 per cent of the body weight of a human adult is contributed by muscles. They have special properties like excitability, contractility, extensibility and elasticity. Muscles have been classified using different criteria, namely location, appearance and nature of regulation of their activities. Based on their location, three types of muscles are identified : (i) Skeletal (ii) Visceral and (iii) Cardiac.

Skeletal muscles are closely associated with the skeletal components of the body. They have a striped appearance under the microscope and hence are called **striated muscles**. As their activities are under the voluntary control of the nervous system, they are known as voluntary muscles too. They are primarily involved in locomotory actions and changes of body postures.

Visceral muscles are located in the inner walls of hollow visceral organs of the body like the alimentary canal, reproductive tract, etc. They do not exhibit any striation and are smooth in appearance. Hence, they are called **smooth muscles (nonstriated muscle)**. Their activities are not under the voluntary control of the nervous system and are therefore known as involuntary muscles. They assist, for example, in the transportation of food through the digestive tract and gametes through the genital tract.

As the name suggests, **Cardiac muscles** are the muscles of heart. Many cardiac muscle cells assemble in a branching pattern to form a cardiac muscle. Based on appearance, cardiac muscles are striated. They are involuntary in nature as the nervous system does not control their activities directly.

Let us examine a skeletal muscle in detail to understand the structure and mechanism of contraction. Each organised skeletal muscle in our body is made of a number of **muscle bundles** or **fascicles** held together by a common collagenous connective tissue layer called **fascia**. Each muscle bundle contains a number of muscle fibres (Figure 20.1). Each


Fascicle
(muscle bundle)
Muscle fibre
(muscle cell)
Sarcolemma
Blood capillary

muscle fibre is lined by the plasma membrane called sarcolemma enclosing the sarcoplasm. Muscle fibre is a syncitium as the sarcoplasm contains many nuclei. The endoplasmic reticulum, i.e., sarcoplasmic reticulum of the muscle fibres is the store house of calcium ions. A characteristic feature of the muscle fibre is the presence of a large number of parallelly arranged filaments in the sarcoplasm called myofilaments or **myofibrils**. Each myofibril has alternate dark and light bands on it. A detailed study of the myofibril has established that the striated appearance is due to the distribution pattern of two important proteins – **Actin** and **Myosin**. The light bands contain actin and is called I-band or Isotropic band, whereas the dark band called 'A' or Anisotropic band contains

THANK YOU !!

MANTHAN NEET 2025

LOCOMOTION AND MOVEMENT

LECTURE - 2

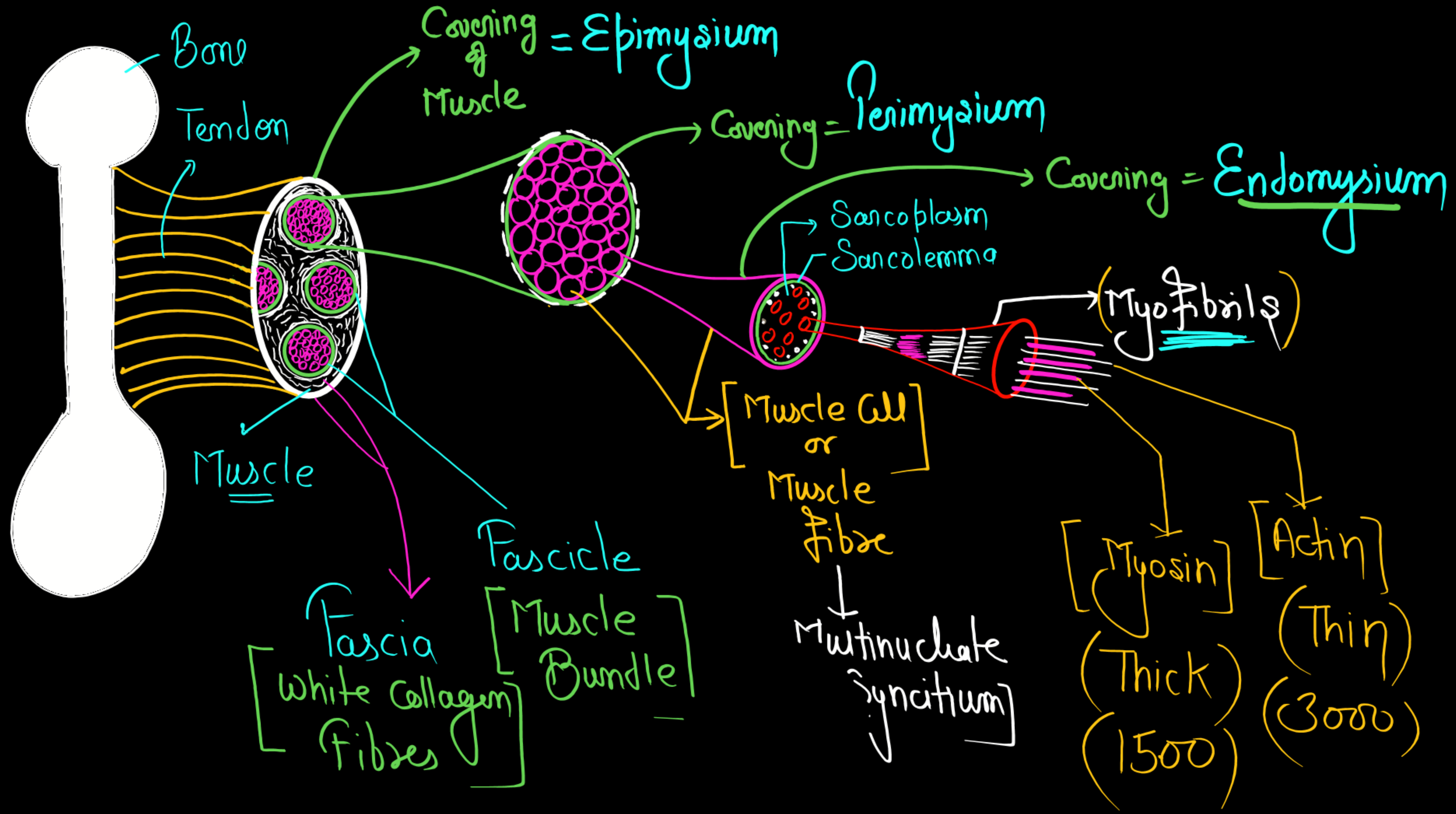
ZOOLOGY



MD SIR

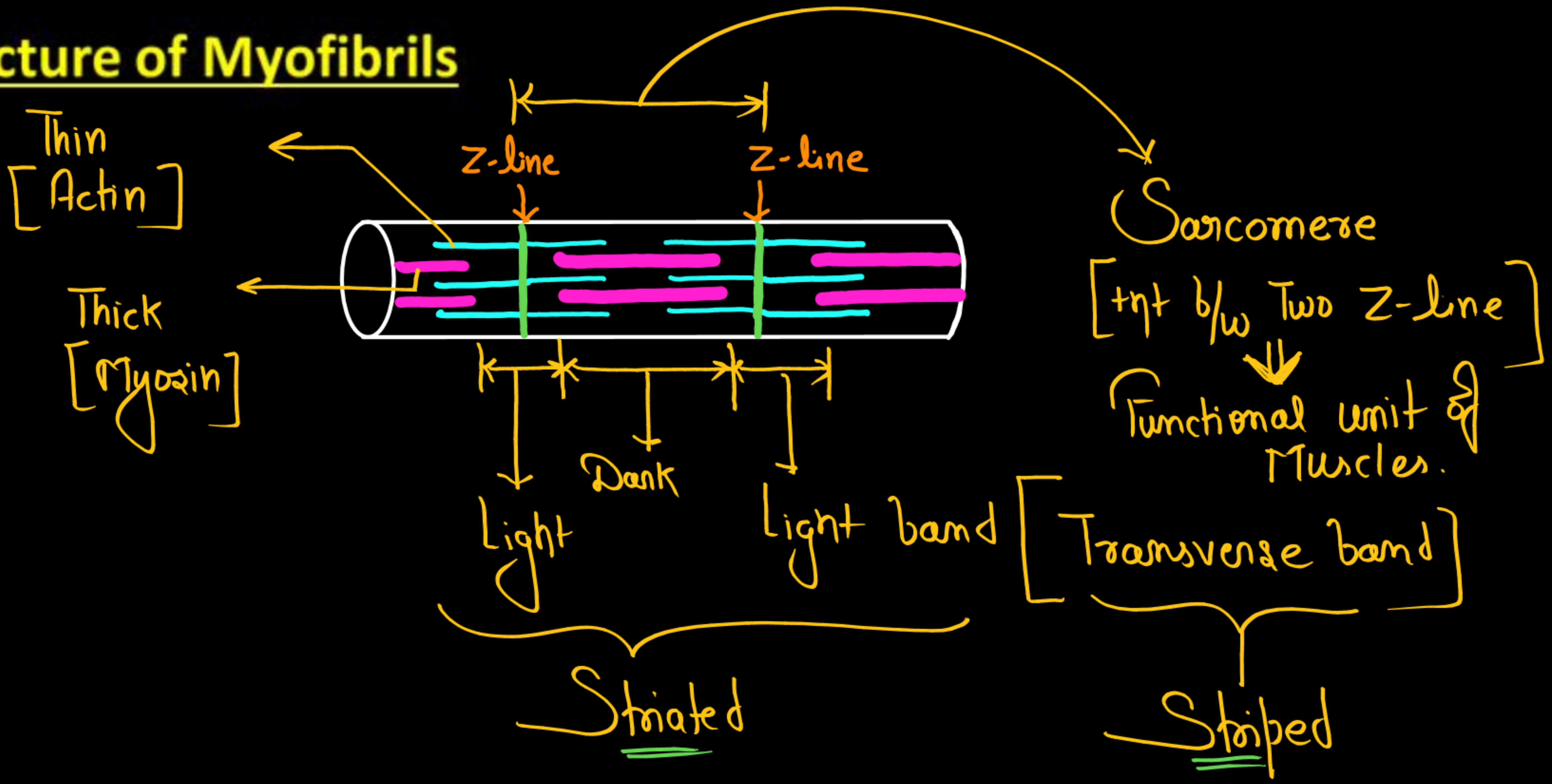
❑ TODAY'S GOAL -

- ❑ Structure of Skeletal Muscle
- ❑ Structure of Contractile Proteins

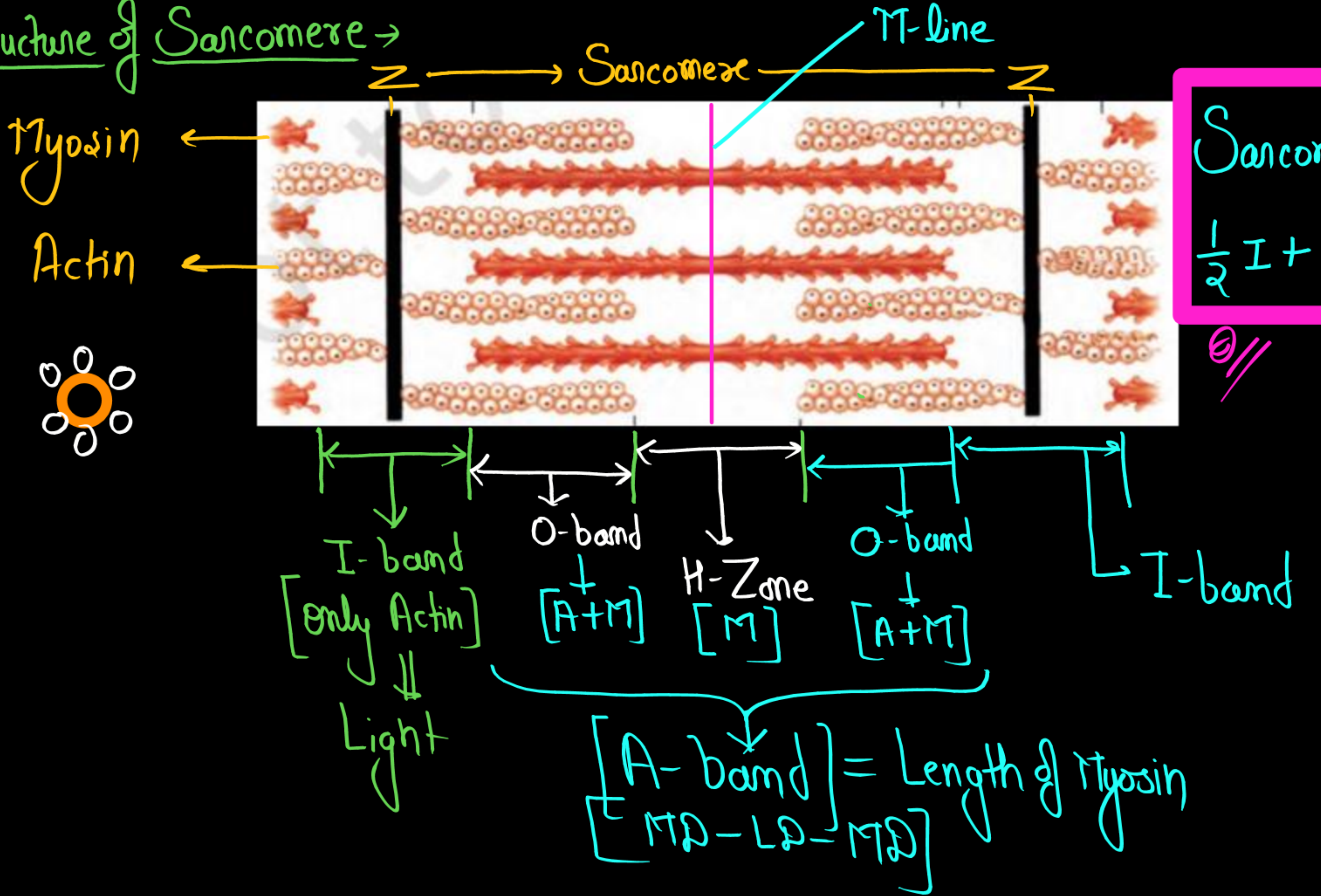


Covering of Muscle = Epimysium
Bone
Tendon
Covering = Perimysium
Covering = Endomysium
Sarcoplasm
Sarcolemma
Myofibrils
Muscle
Muscle Cell or Muscle Fibre
Multinucleate Syncitium
Fascicle [Muscle Bundle]
Fascia [White Collagen Fibres]
[Myosin] (Thick) (1500)
[Actin] (Thin) (3000)

Structure of Myofibrils



Structure of Sarcomere →



Sarcomere = $\frac{1}{2}I + A + \frac{1}{2}I$

M-line = tnt b/w A-band }
Z-line = tnt b/w I-band } ②

I-band (Isotropic-band) = Light (only Actin tnt)

A-band (Anisotropic-band) = MD — LD — MD

MD → O (A+M); LD → H (M); MD → O (A+M)

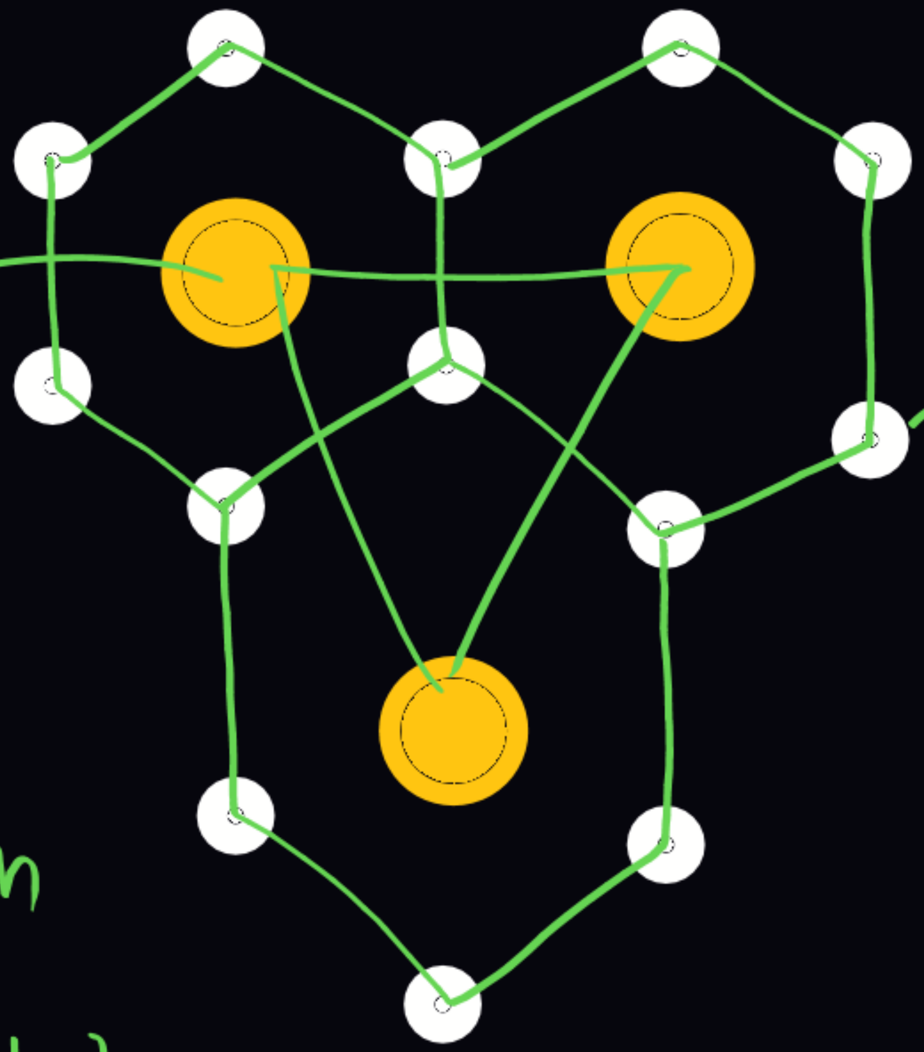
O = obenlaping

A-band → length of Myosin

O = ovenlaping band = Ovenlaping part of A-band.

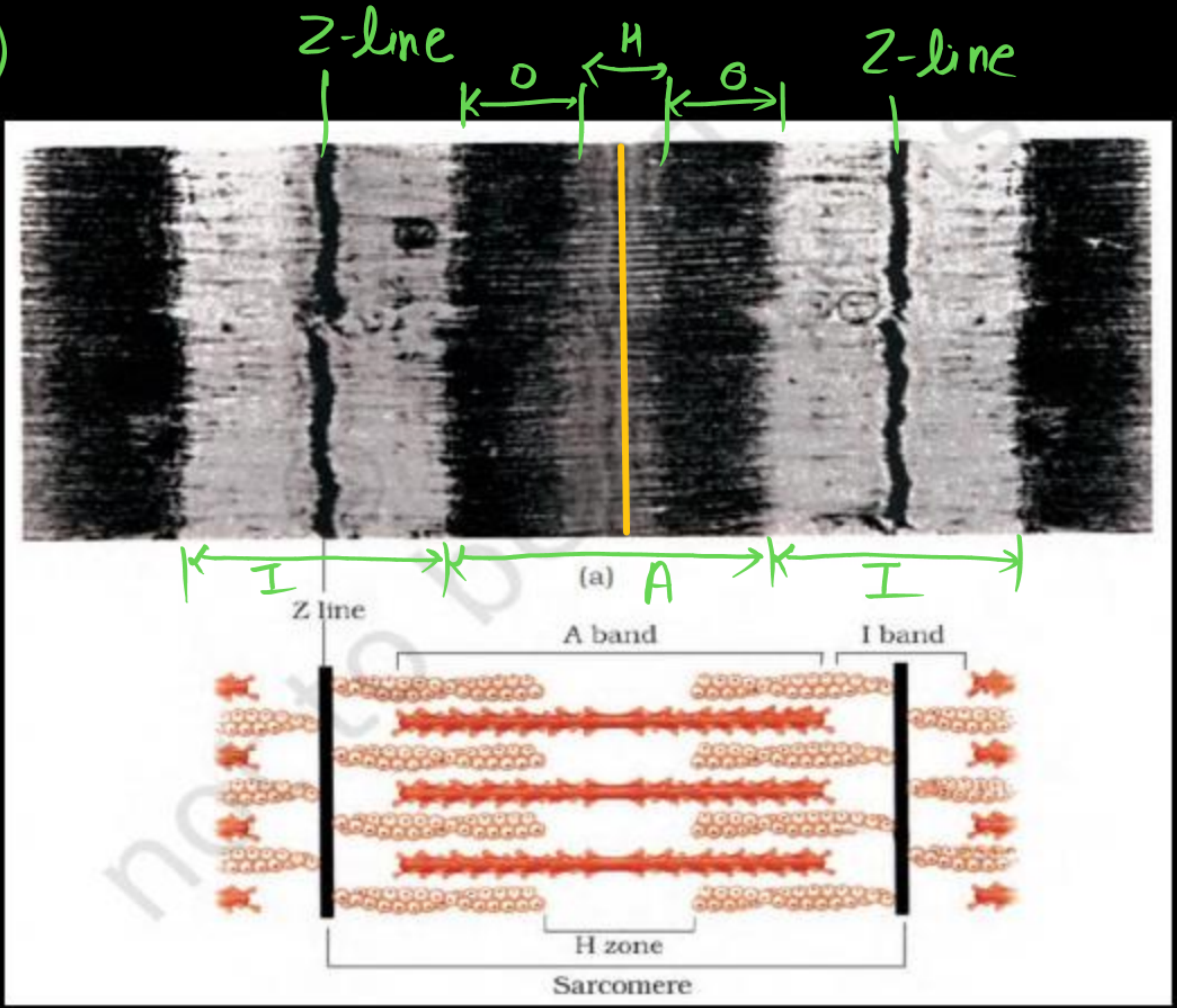
H = Henson Zone = NonOvenlaping part of A band

(Myosin)
↓
Single Myosin
Surrounded by
6 - Actin



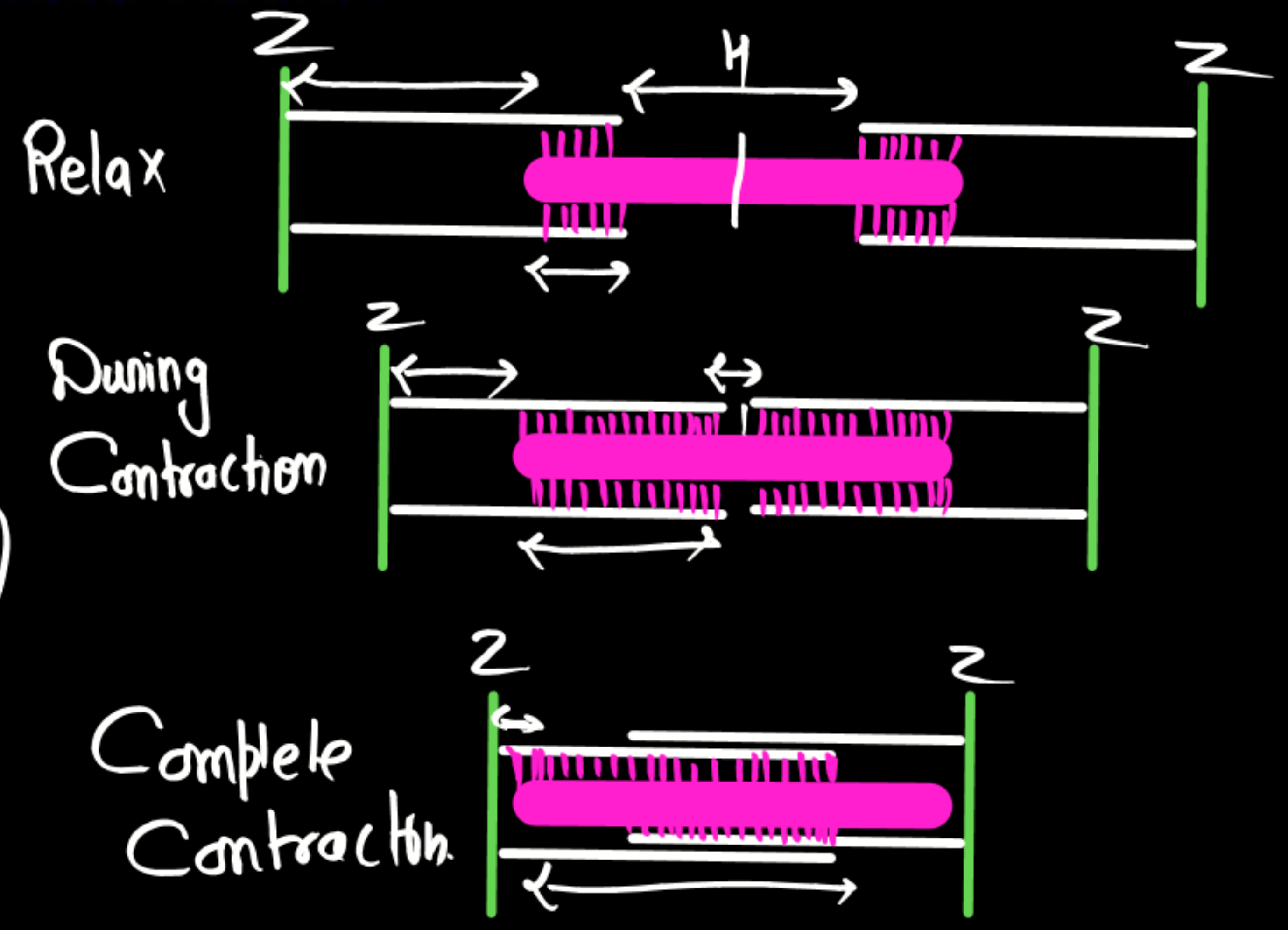
(Actin)
↓
Single Actin Surrounded
by = 3 - Myosin.

NCERT



During Complete contraction of muscle –

- Length of Sarcomere = ↓
- Length of I Band = ↓
- Length of H Zone = Disappear (↓)
- M-line = Disappear
- Length of O band = ↑
- Length of A band = unchange



Structure of Contractile Protein

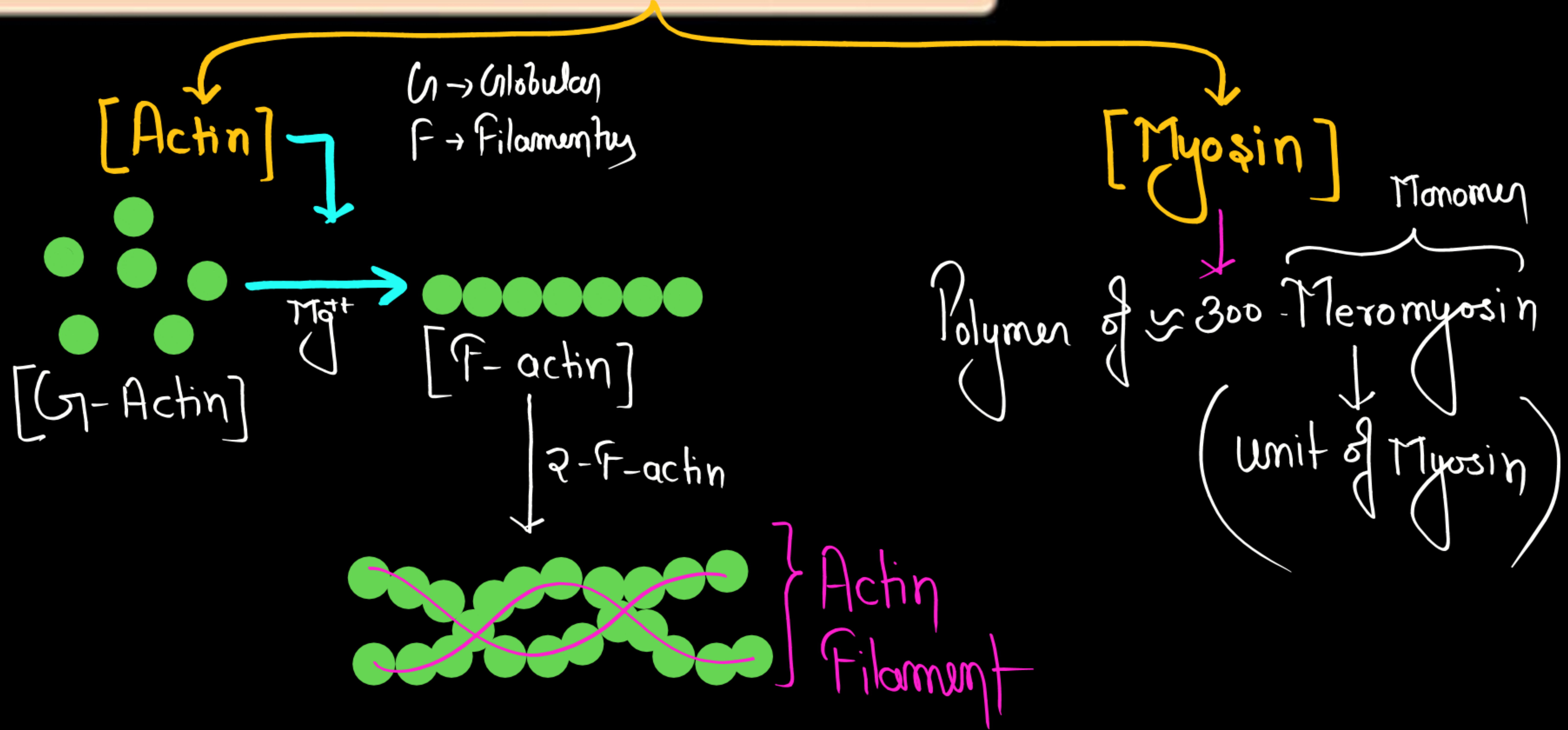
① Force generating Protein
- 1) - Actin (Thin filament)
- 2) - Myosin (Thick filament)

② Regulating Protein
- 1) - Tropomyosin
- 2) - Troponin

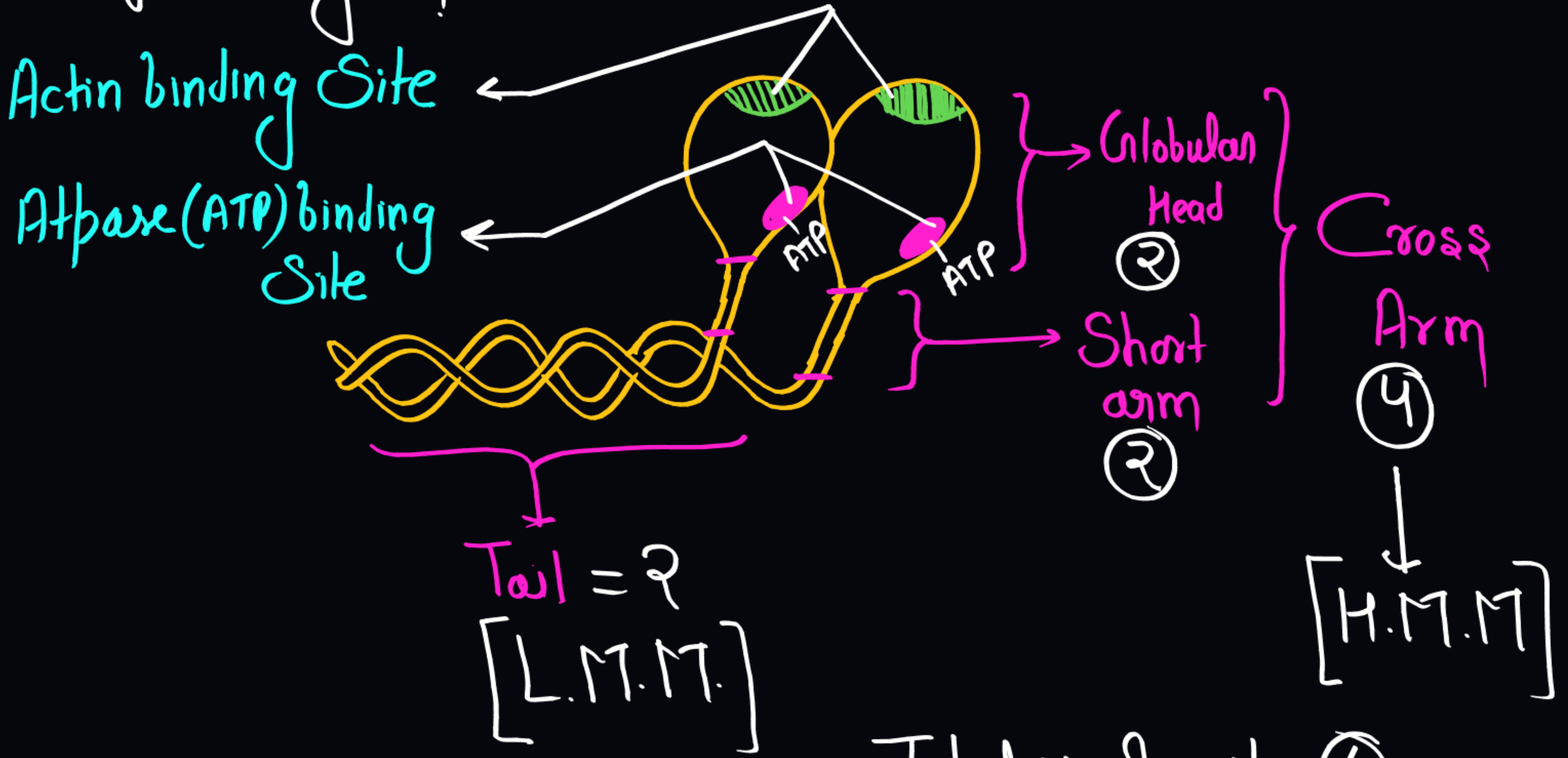
Tropomyosin and Troponin → Part of Thin filament

Structural Protein → (Z-line Protein)

Structure of Force Generating Proteins



Structure of Meromyosin →



Total No. of unit = ⑥

Structure of Regulating Proteins

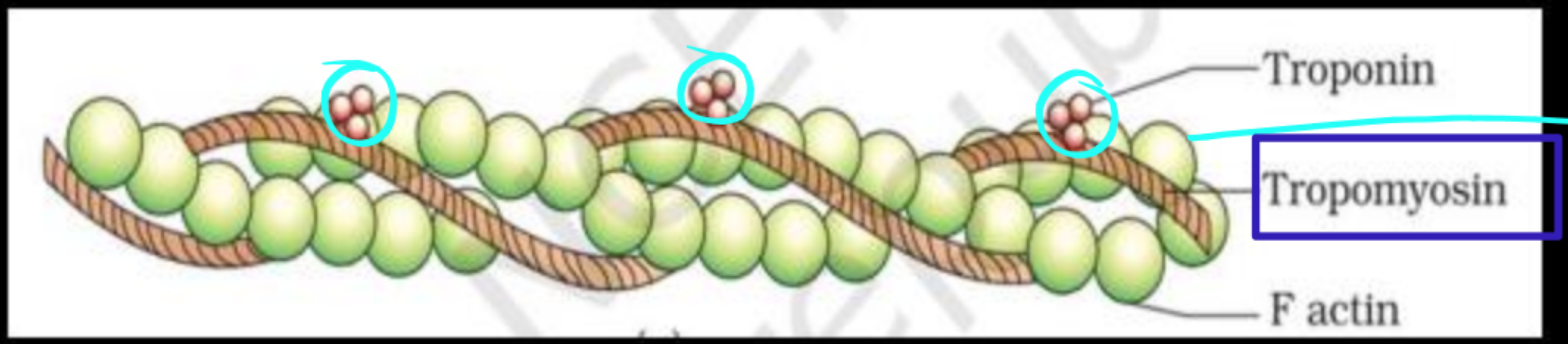
[Tropomyosin]

Two filament of Tropomyosin run close to Actin filament throughout length & inhibit interaction of Actin & Myosin

[Troponin]

Imp

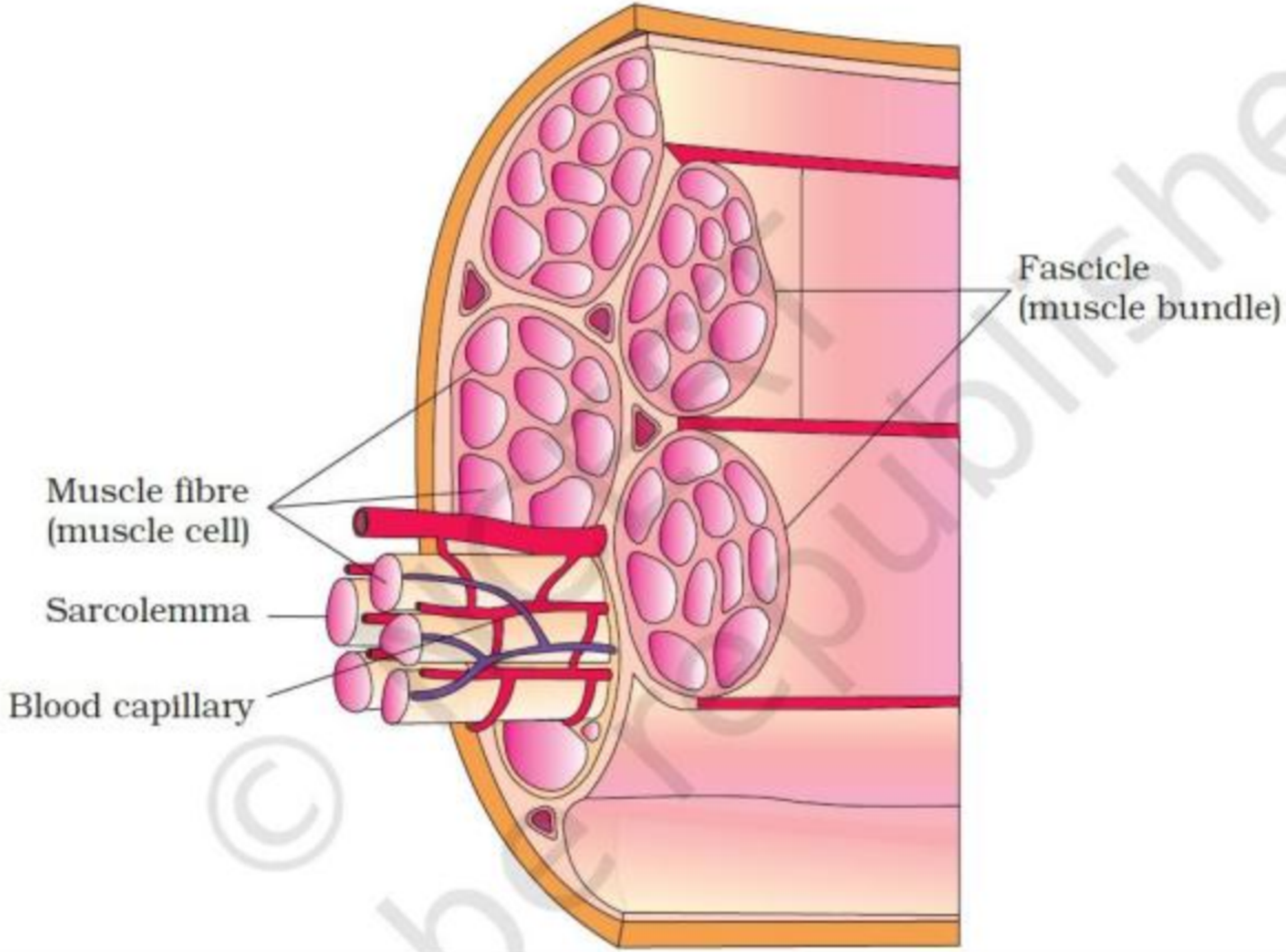
It is a Complex protein [3-unit] ... on Tropomyosin at regular interval.



Troponin
- → TpC = Ca^{++} binding Troponin
- → TpT = Tropomyosin binding Troponin
- → TpI = Inhibit interaction of Aactin & Myosin by = Masking Active Site of Actin.

As the name suggests, **Cardiac muscles** are the muscles of heart. Many cardiac muscle cells assemble in a branching pattern to form a cardiac muscle. Based on appearance, cardiac muscles are striated. They are involuntary in nature as the nervous system does not control their activities directly.

Let us examine a skeletal muscle in detail to understand the structure and mechanism of contraction. Each organised skeletal muscle in our body is made of a number of **muscle bundles** or **fascicles** held together by a common collagenous connective tissue layer called **fascia**. Each muscle bundle contains a number of muscle fibres (Figure 20.1). Each


Fascicle
(muscle bundle)
Muscle fibre
(muscle cell)
Sarcolemma
Blood capillary

muscle fibre is lined by the plasma membrane called sarcolemma enclosing the sarcoplasm. Muscle fibre is a syncitium as the sarcoplasm contains many nuclei. The endoplasmic reticulum, i.e., sarcoplasmic reticulum of the muscle fibres is the store house of calcium ions. A characteristic feature of the muscle fibre is the presence of a large number of parallelly arranged filaments in the sarcoplasm called myofilaments or **myofibrils**. Each myofibril has alternate dark and light bands on it. A detailed study of the myofibril has established that the striated appearance is due to the distribution pattern of two important proteins – **Actin** and **Myosin**. The light bands contain actin and is called I-band or Isotropic band, whereas the dark band called 'A' or Anisotropic band contains

myosin. Both the proteins are arranged as rod-like structures, parallel to each other and also to the longitudinal axis of the myofibrils. Actin filaments are thinner as compared to the myosin filaments, hence are commonly called thin and thick filaments respectively. In the centre of each 'I' band is an elastic fibre called 'Z' line which bisects it. The thin filaments are firmly attached to the 'Z' line. The thick filaments in the 'A' band are also held together in the middle of this band by a thin fibrous membrane called 'M' line. The 'A' and 'I' bands are arranged alternately throughout the length of the myofibrils. The portion of the myofibril between two successive 'Z' lines is considered as the functional unit of contraction and is called a sarcomere (Figure 20.2). In a resting state, the edges of thin filaments on either side of the thick filaments partially overlap the free ends of the thick filaments leaving the central part of the thick filaments. This central part of thick filament, not overlapped by thin filaments is called the 'H' zone.

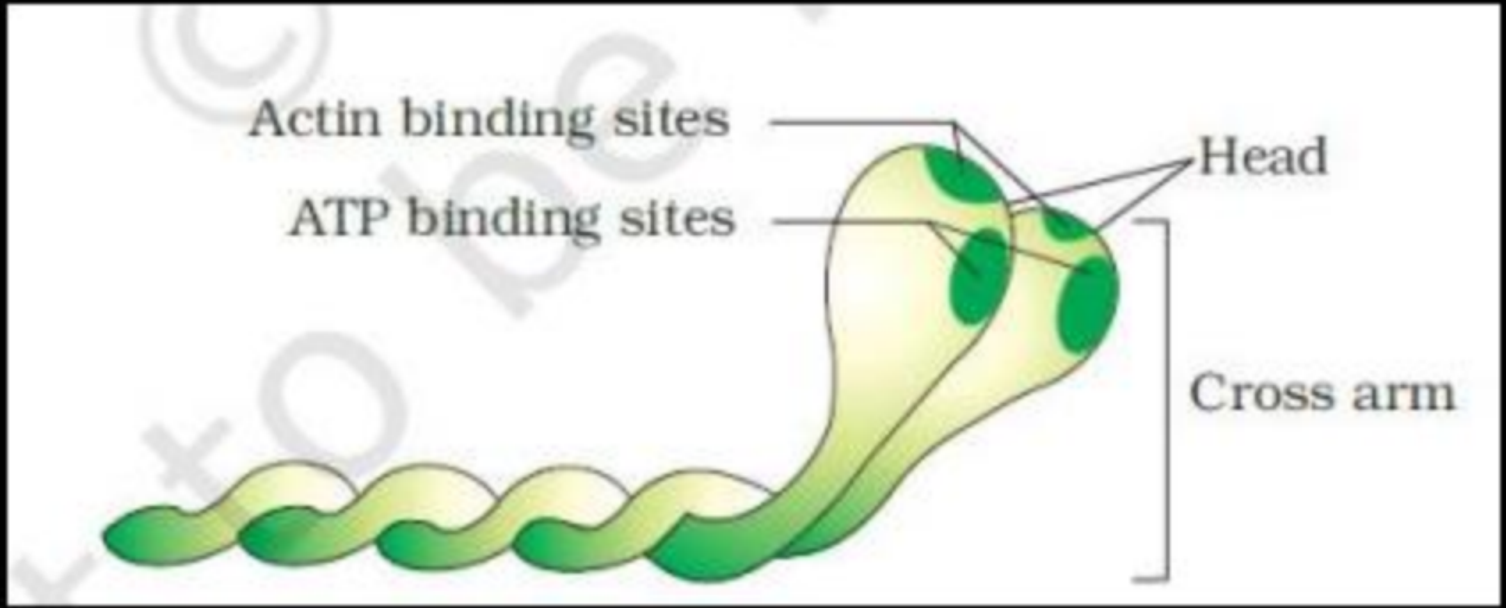
20.2.1 Structure of Contractile Proteins

Each actin (thin) filament is made of two 'F' (filamentous) actins helically wound to each other. Each 'F' actin is a polymer of monomeric 'G' (Globular) actins. Two filaments of another protein, tropomyosin also run close to the 'F' actins throughout its length. A complex protein Troponin is distributed at regular intervals on the tropomyosin. In the resting state a subunit of troponin masks the active binding sites for myosin on the actin filaments (Figure 20.3a).



(a)

Each myosin (thick) filament is also a polymerised protein. Many monomeric proteins called Meromyosins (Figure 20.3b) constitute one thick filament. Each meromyosin has two important parts, a globular head with a short arm and a tail, the former being called the heavy meromyosin (HMM) and the latter, the light meromyosin (LMM). The HMM component, i.e.; the head and short arm projects outwards at regular distance and angle from each other from the surface of a polymerised myosin filament and is known as cross arm. The globular head is an active ATPase enzyme and has binding sites for ATP and active sites for actin.



H.W.

1. Streaming of cytoplasm/cyclosis is seen in –

(a) Amoeba
(B) Macrophages
(C) Leukocytes
(D) All

2. Which of the following statements is correct?

(A) Cytoplasmic streaming helps in pseudopodia formation or amoeboid movement
(B) Cytoplasmic streaming is caused by contracting microfilament
(C) Both a and b
(D) Locomotion is not a voluntary movement

3. Which of the following statements is false?

(A) Locomotion and many other movements required coordinated muscular activities
(B) Muscle is a specialised tissues of endodermal in origin
(C) There are about 639 muscles which contribute about 40 - 50 % of adult body weight
(D) Muscles show contractibility, excitability and flexibility

4. Which of the following statements about the skeletal muscles is correct?
(A) They are striated muscles
(B) They are voluntary muscles
(C) They are primarily involved in locomotory actions
(D) All

5. The fascia surrounding a muscle is made up of -
(A) Cartilage
(B) Collagenous connective tissues
(C)Adipose tissue
(D) Blood vessels

6. Contractile fibrils of muscles are called -
(A) Neurofibrils
(B) Collagen fibres
(C) Myofibrils
(D) Yellow fibres

7. Myofibrils show alternate dark and light bands in -
(A) Cardiac muscles
(B) Smooth muscles
(C) Striped muscles
(D) a and c

8. Which is the smallest one?
(A) Muscle fibre
(B) Myofibril
(C) Actin
(D) Sarcomere

9. Z-line divides the myofibrils into -
(A) Sarcomere
(B) Sarcolemma
(C) Sarcosome
(D) Microtubules

10. Sarcomere is the area between -
(A) 2 H-zones
(B) 2 Z-lines
(C) 2 M-lines
(D) 2A-bands

11. Light bands (thin filaments) contain actin and are called -
(A) A-bands or Isotropic band
(B) A-bands or Anisotropic bands
(C) I-bands or Isotropic bands
(D) I-bands or Anisotropic bands

12. Dark bands (thick filaments) contain myosin and are called -
(A) A-bands or Isotropic band
(B) A-bands or Anisotropic bands
(C) I-bands or Isotropic bands
(D) I-bands or Anisotropic bands

13. The region between the ends of the A-bands of 2-adjoining sarcomeres is called -
(A) The Z-band
(B) The H-zone
(C) The T-tubule
(D) The I-band

14. The functions of tropomyosin in skeletal muscle include -
(A) Sliding on actin to produce shortening.
(B) Release Ca+2 after initiation of contraction
(C) Acting as "relaxing protein" at rest by \covering up the sites where myosin binds to actin
(D) Generates ATP

15. Tropomyosin is moved by which of following proteins -
(A) Calmodulin
(B) Actin
(C) Troponin
(D)Acetylcholine

THANK YOU !!

MANTHAN NEET 2025

LOCOMOTION AND MOVEMENT

LECTURE - 3

ZOOLOGY

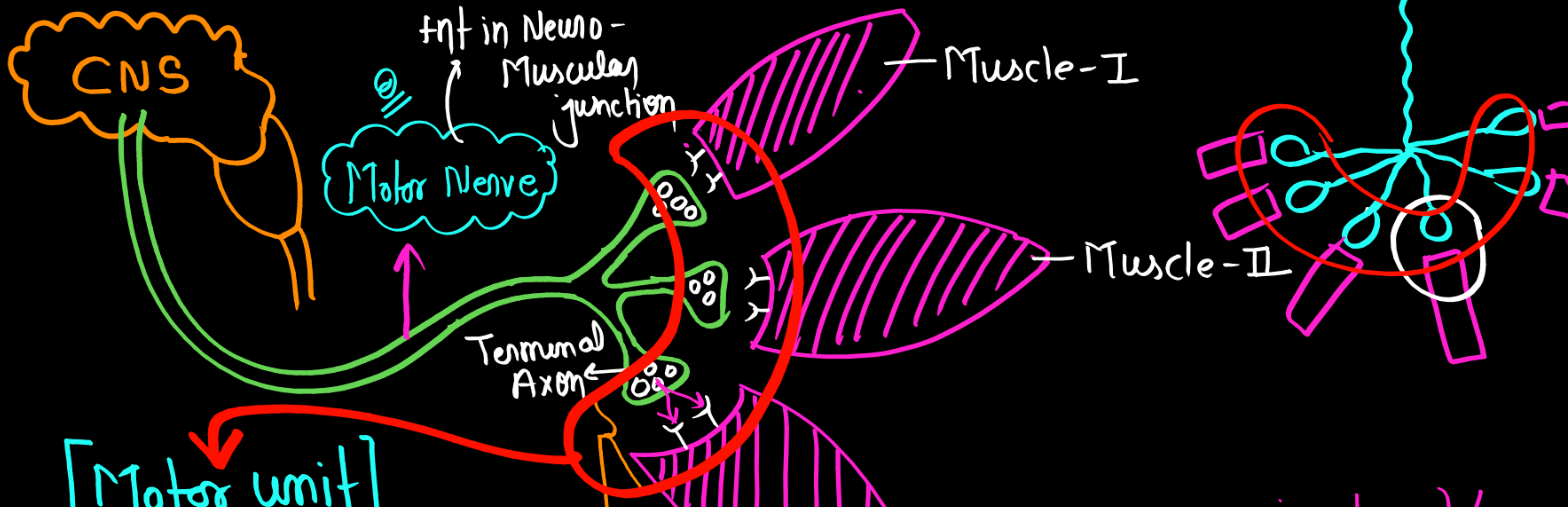


MD SIR

❑ TODAY'S GOAL -

- ❑ Mechanism of Muscle contraction ✓
- ❑ Difference between Red and White muscle ✓
- ❑ Types of Muscle ✓

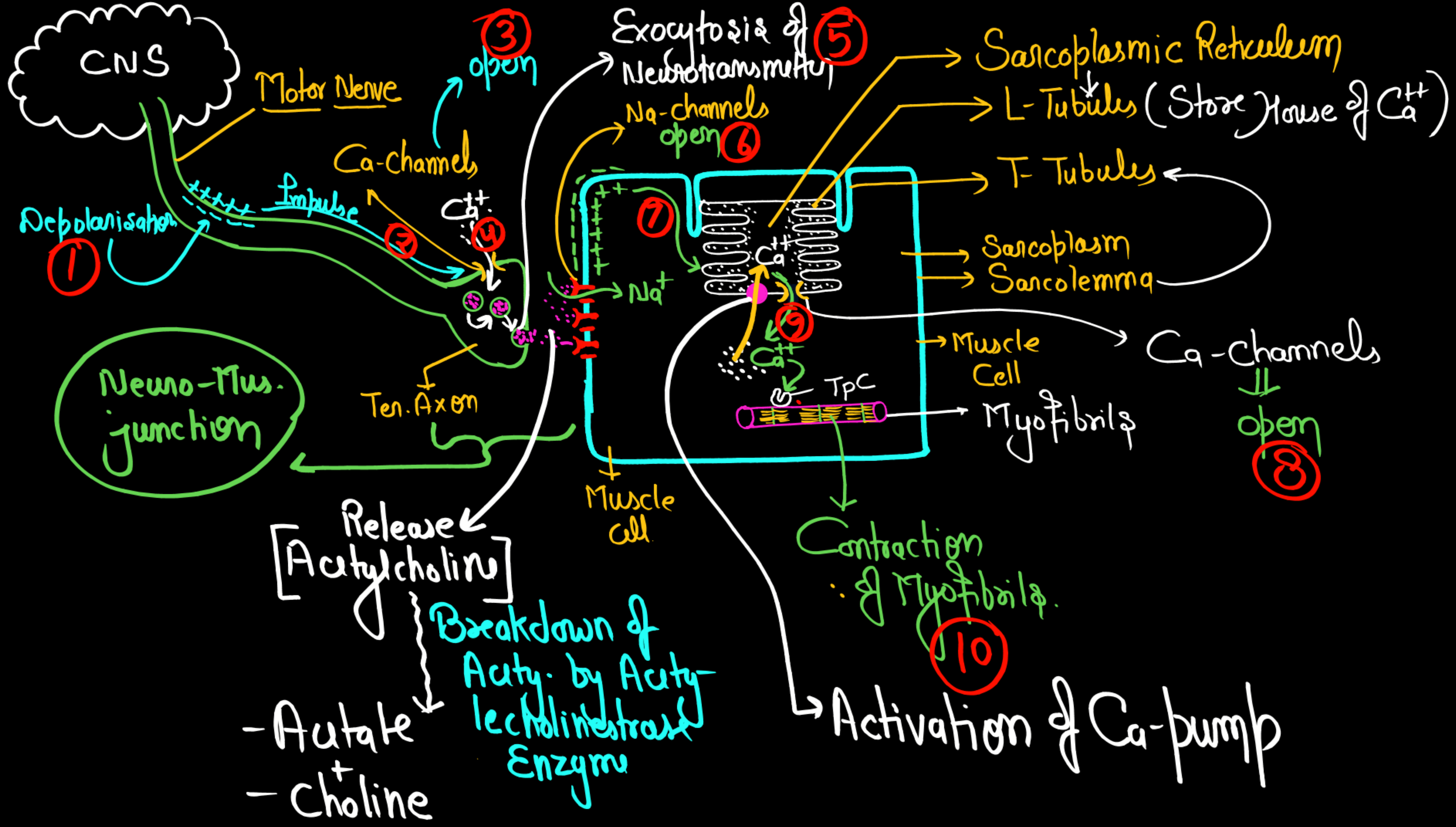
Mechanism of Muscle Contraction

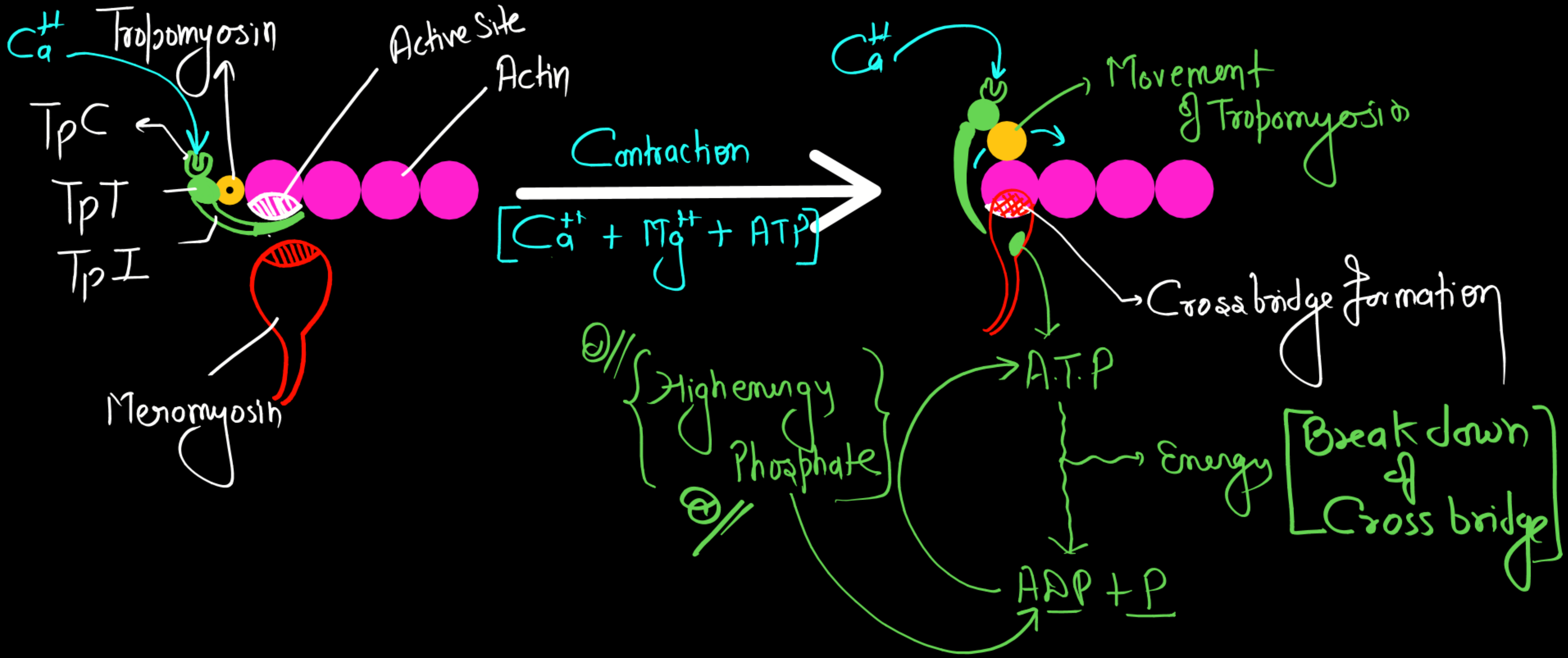


[Motor unit]
junction b/w
Single Nerve & Group of Muscles

Neuro-Muscular junction or Motor end plate

junction b/w Single Nerve & Single Muscle


CNS
Motor Nerve
Depolarisation
1
Impulse
2
Ca-Channels
open
3
Ca^{++}
4
Exocytosis of Neurotransmitter
5
Na-channels open
6
Na^{+}
7
Ten. Axon
Neuro-Mus. junction
Release [Acetylcholine]
Breakdown of Acety. by Acetylecholinestrase Enzyme
- Acetate + - Choline
Muscle cell
Sarcoplasmic Reticulum
L-Tubules (Store House of Ca^{++})
T-Tubules
Sarcoplasm
Sarcolemma
Muscle Cell
Ca-Channels
open
8
Ca^{++}
9
TpC
Myofibrils
Contraction of Myofibrils
10
Activation of Ca-pump



Ca^{++}
Tropomyosin
Active Site
Actin
TpC
TpT
TpI
Meromyosin
Contraction
[Ca^{++} + Mg^{++} + ATP]
Ca^{++}
Movement of Tropomyosin
Crossbridge formation
A.T.P
Energy
[Breakdown of Cross bridge]
ADP + P
High energy Phosphate

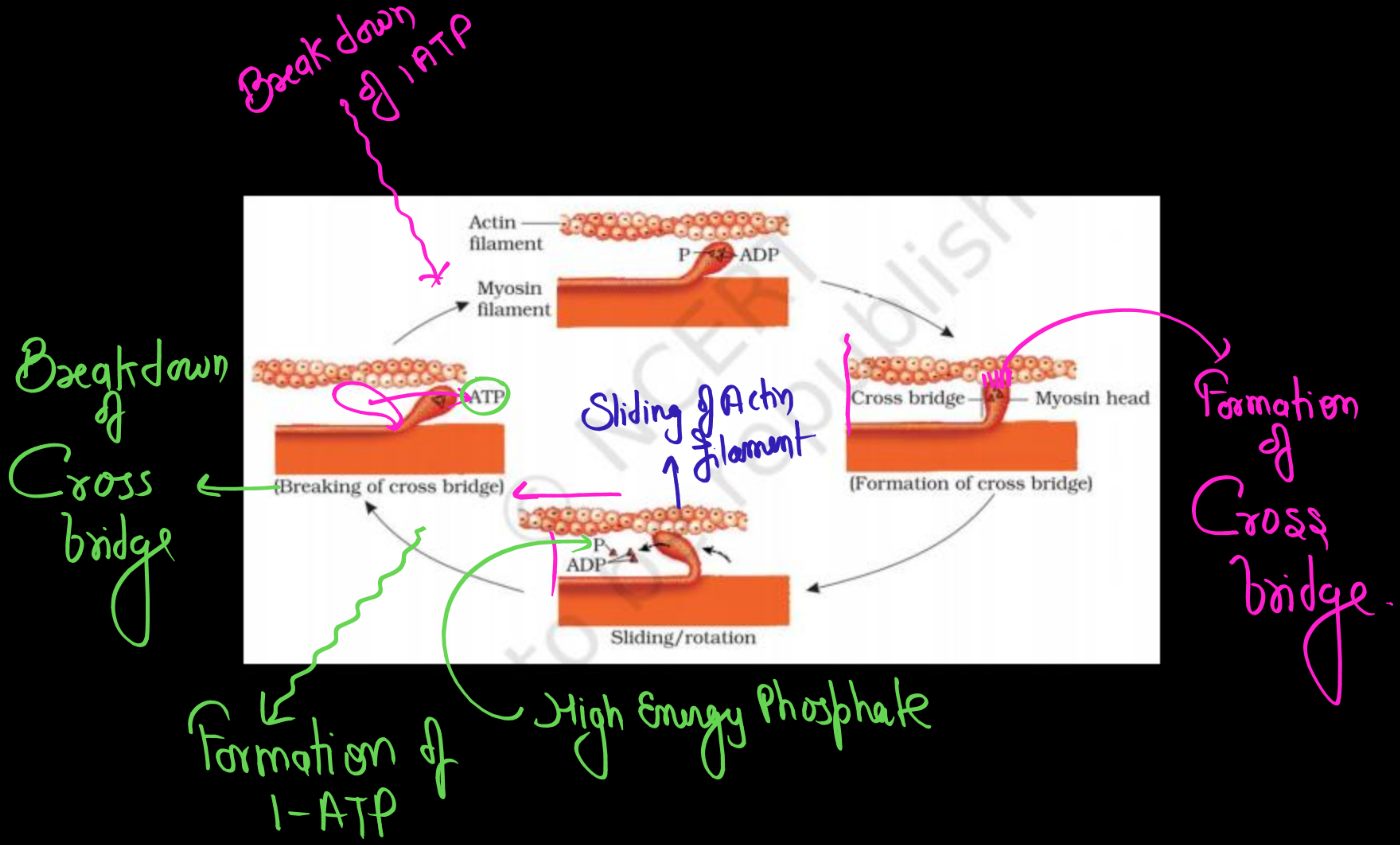
Source of High Energy Phosphate → High Energy Phosphate

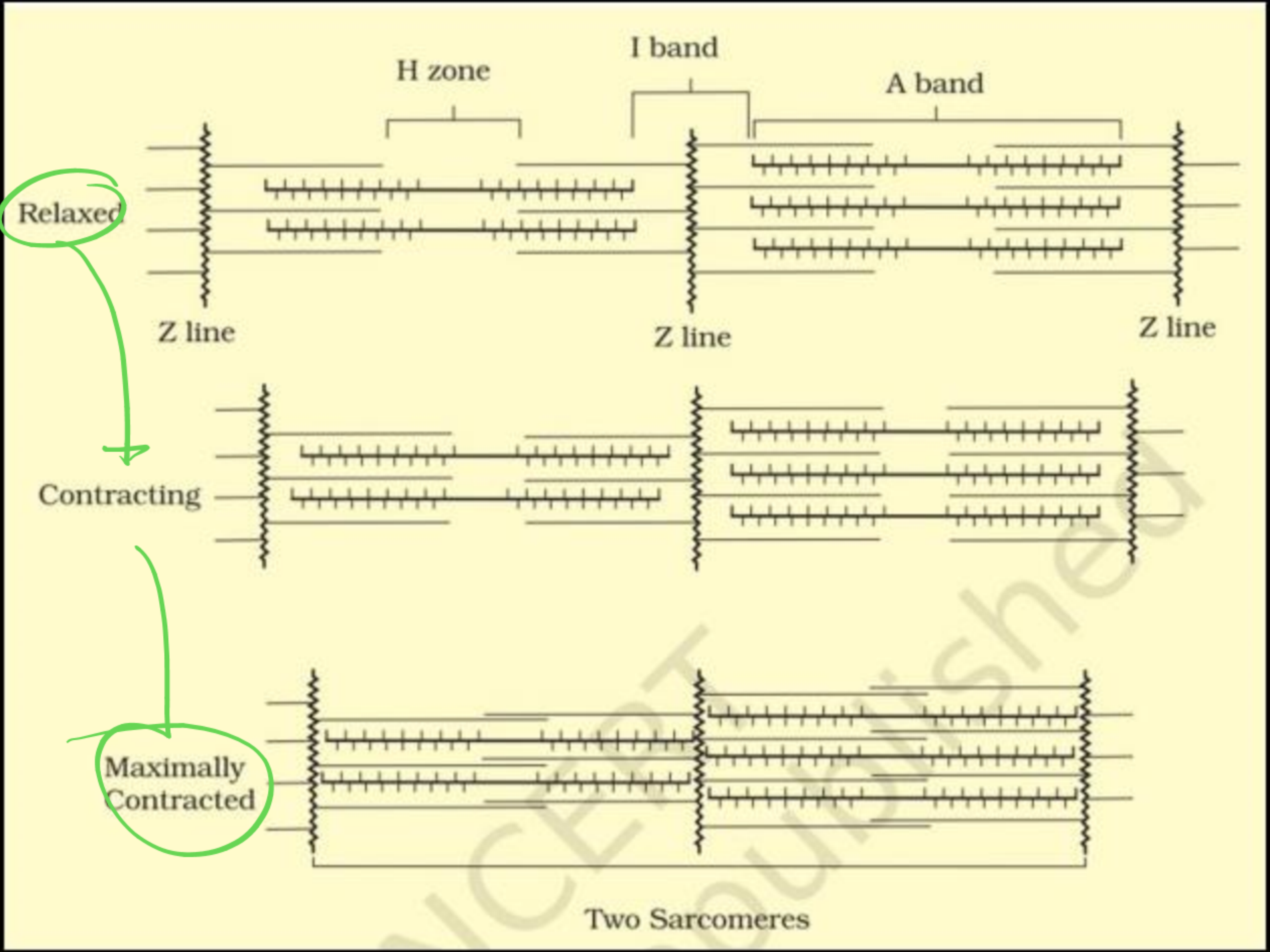
✓ 1) - Creatine Phosphate $\rightleftharpoons$ Creatine

(forward: releases High Energy Phosphate; reverse: ATP → ADP + P)

2) → Anaerobic Respiration

Note → In case of Red Muscle = Aerobic Respiration


Break down of 1 ATP
Actin filament
P
ADP
Myosin filament
Breakdown of Cross bridge
ATP
(Breaking of cross bridge)
Sliding of Actin filament
Cross bridge
Myosin head
(Formation of cross bridge)
Formation of Cross bridge.
P
ADP
Sliding/rotation
Formation of 1-ATP
High Energy Phosphate



H zone
I band
A band
Relaxed
Z line
Z line
Z line
Contracting
Maximally Contracted
Two Sarcomeres
NCERT
published

During Relaxation of Muscle. →

1) → Breakdown of Acetylicholine.

2) → Activation of Ca-pump.

3) - Releas of Ca^{++} from TpC

Red and White Muscle Fibers

Red Fibers

1. Diameter = Small
2. Red protein (Myoglobin) = More
3. Mitochondria = More
4. Show aerobic oxidation without deposition of Lactic acid.

1. Less S.R. → Ca^{++} ↓
2. Slow - Contraction.
3. Mus. fibers contract for longer period without fatigue.

Example:- Back extensor muscles .
Red meat of chicken leg and thighs.
Fright Muscles of kites

White Fibers

Large
Less Myoglobin
Less mitochondria
Show – Anaerobic oxidation and more deposition of Lactic acid
More S.R. → Ca^{++} ↑
Fast – Contraction
Show – High Rate of centration for short period.

Example:- Eye ball muscles.
White muscles of chickens breast.
Fight muscles of sparrow.

H.W.

1. Streaming of cytoplasm/cyclosis is seen in –

(a) Amoeba (B) Macrophages
(C) Leukocytes (D) All

2. Which of the following statements is correct?

(A) Cytoplasmic streaming helps in pseudopodia formation or amoeboid movement
(B) Cytoplasmic streaming is caused by contracting microfilament
(C) Both a and b
(D) Locomotion is not a voluntary movement

3. Which of the following statements is false?

(A) Locomotion and many other movements required coordinated muscular activities
(B) Muscle is a specialised tissues of endodermal in origin
(C) There are about 639 muscles which contribute about 40 - 50 % of adult body weight
(D) Muscles show contractibility, excitability and flexibility

4. Which of the following statements about the skeletal muscles is correct?
(A) They are striated muscles
(B) They are voluntary muscles
(C) They are primarily involved in locomotory actions
(D) All

5. The fascia surrounding a muscle is made up of -
(A) Cartilage (B) Collagenous connective tissues
(C)Adipose tissue (D) Blood vessels

6. Contractile fibrils of muscles are called -
(A) Neurofibrils (B) Collagen fibres
(C) Myofibrils (D) Yellow fibres

7. Myofibrils show alternate dark and light bands in -
(A) Cardiac muscles (B) Smooth muscles
(C) Striped muscles (D) a and c

8. Which is the smallest one?
(A) Muscle fibre (B) Myofibril
(C) Actin (D) Sarcomere

9. Z-line divides the myofibrils into -
(A) Sarcomere (B) Sarcolemma
(C) Sarcosome (D) Microtubules

10. Sarcomere is the area between -
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(C) Acting as "relaxing protein" at rest by \covering up the sites where myosin binds to actin
(D) Generates ATP

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(C) Troponin (D)Acetylcholine

THANK YOU !!

MANTHAN NEET 2025

LOCOMOTION AND MOVEMENT

LECTURE – 4

ZOOLOGY



MD SIR

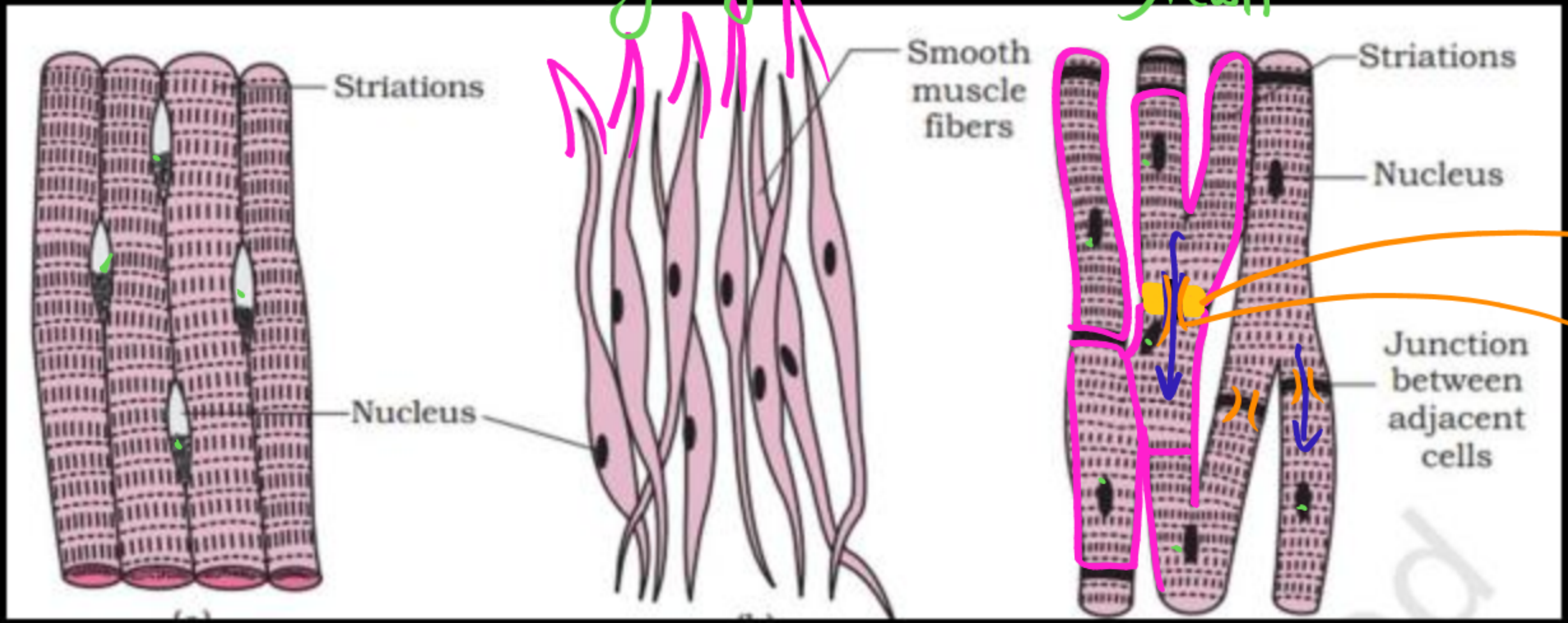
❑ TODAY'S GOAL -

- ❑ Types of Muscle ✓
- ❑ Human Skeletal System -1 ✓

Skeletal Muscle	Smooth Muscle	Cardiac Muscle
Striated Mus.	Body Organs	Striated Mus. Heart

+nt in Limbs & Tongue

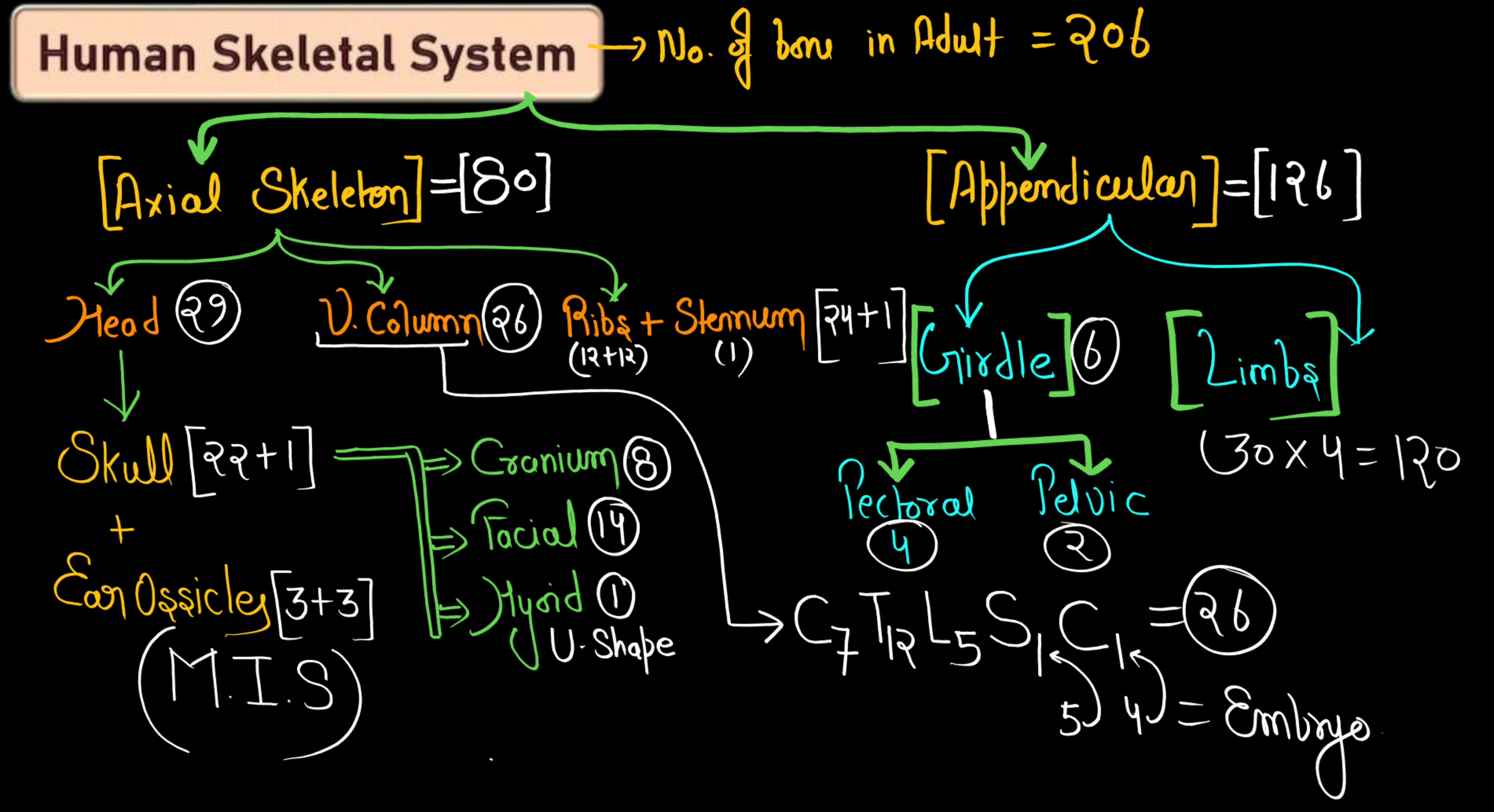
only +nt in Cardiac Muscle



① Intercalated Disc

② Gap junction

Skeletal Muscle	Smooth Muscle	Cardiac Muscle
• Cylindrical & unbranched	Spindle Shape	Cylindrical & Branched
• Light & Dark band +nt	-nt	+nt
• Multinucleated	uninucleated	uninucleated
• Control by = S.N.A	ANS	A.N.S



Human Skeletal System
No. of bone in Adult = 206
[Axial Skeleton] = [80]
[Appendicular] = [126]
Head 29
V. Column 26
Ribs + Sternum [24+1]
(12+12)
(1)
Skull [22+1]
Cranium 8
Facial 14
Hyoid 1
U-Shape
+
Ear Ossicles [3+3]
(M.I.S)
C7 T12 L5 S1 C1 = 26
5) 4) = Embryo
[Girdle] 6
[Limbs]
30 x 4 = 120
Pectoral 4
Pelvic 2

Skull = 23

[Cranium] = 8

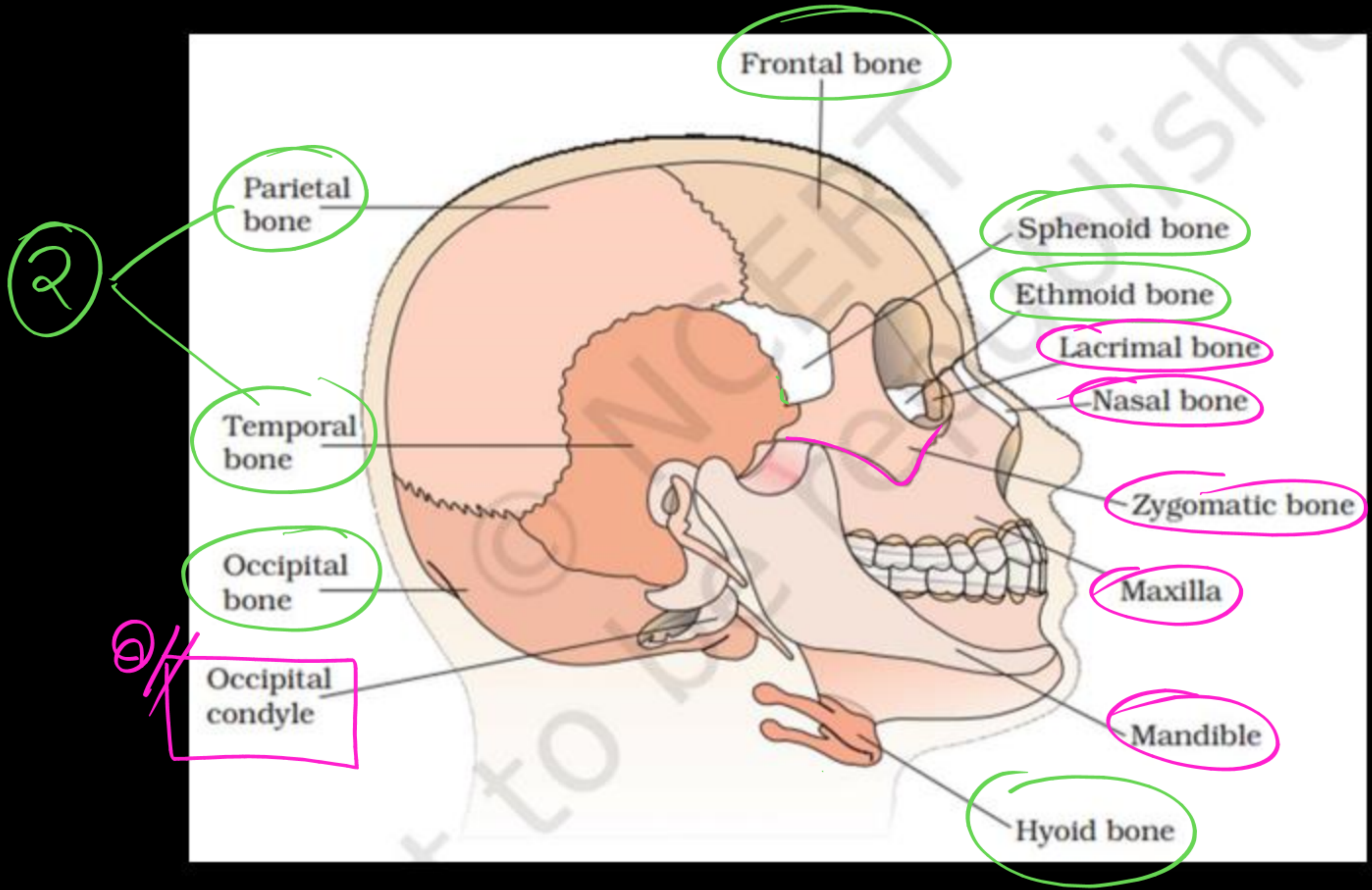
1) = Frontal = 1
2) = Parietal = 2 } Paired
3) = Temporal = 2 }
4) = Occipital = 1
5) = Sphinoid = 1
6) = Ethmoid = 1

[Facial] = 14

1) → Lacrimal = 2
2) → Zygomatic = 2
3) → Nasal = 2
4) - Inferior Conchae = 2
5) - Vomer = 1 — (unpair)
6) - Maxilla = 2
7) - Mandible = 1 — (unpair)
8) - Palatine = 2

[Hyoid] = 1

↓
U-Shape
↓
Single


Frontal bone
Parietal bone
Sphenoid bone
Ethmoid bone
Lacrimal bone
Nasal bone
Temporal bone
Zygomatic bone
Occipital bone
Maxilla
Occipital condyle
Mandible
Hyoid bone
2

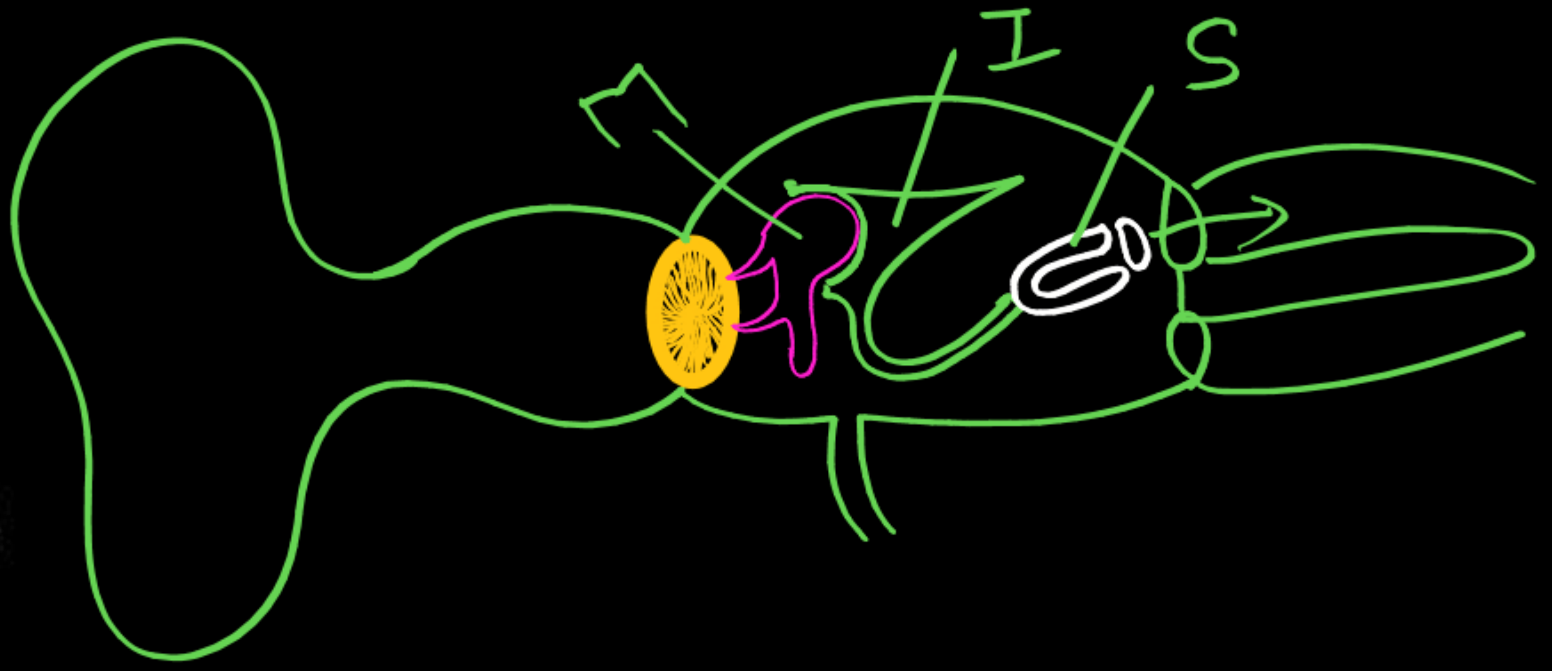
Ear Ossicles [3+3]=6

2 - Malleus - Hammer Shape

2 - Incus - Anvil Shape

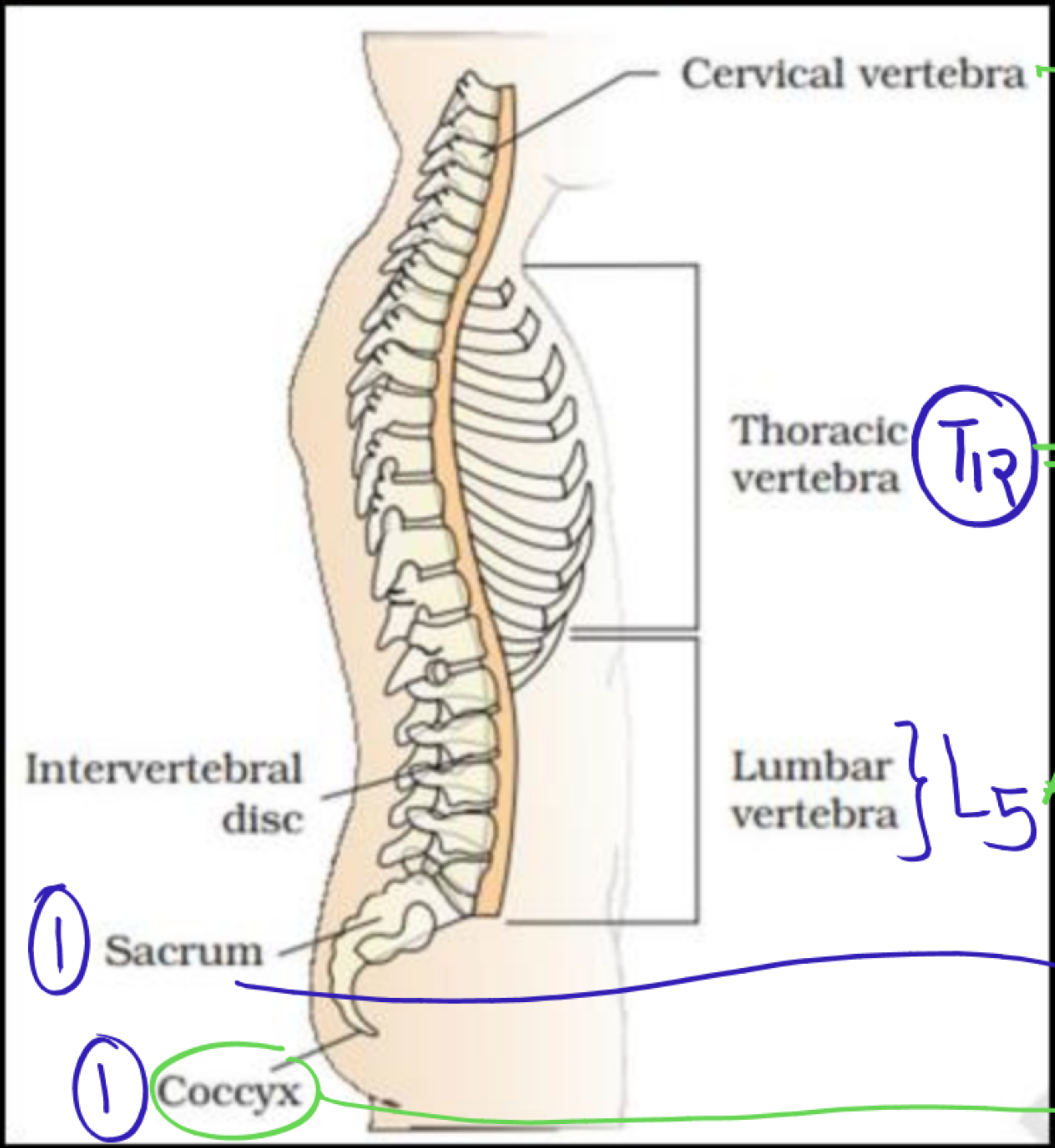
2 - Stapes - Stirrup Shape

→ Smallest bone of body



Vertebral Column

= $C_7 T_{12} L_5 S_1 C_1$ = 26



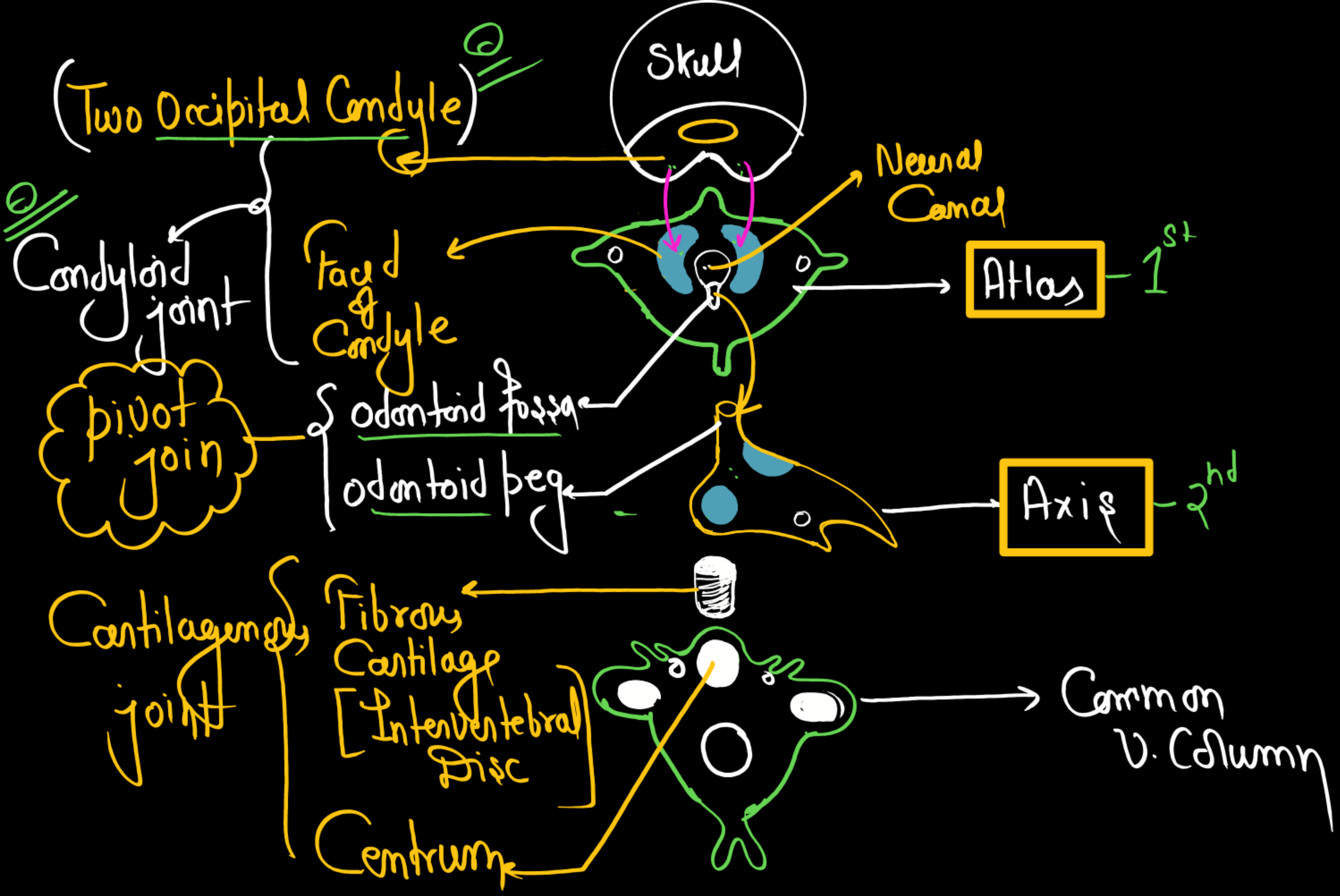
Cervical: 7
- → 7 [illegible] in all Mammals.
- → Ist → Atlas
- → IInd → Axis

Thoracic: T_{12} = 12 → Two articulating Surface for attachment of Ribs

Lumbar: L_5
- → Strongest
- → Thickest
- → Lumber Curve.

Sacrum: 5 → 1

Coccyx: Tail bone = 4 → 1


(Two Occipital Condyle)
Skull
Neural Canal
Condyloid joint
Facet of Condyle
Atlas
1st
pivot joint
odontoid fossa
odontoid peg
Axis
2nd
Cartilagenous joint
Fibrous Cartilage
[Intervertebral Disc]
Centrum
Common V. Column

1. Hyoid/Tongue bone is -

(A) T-shaped
(B) J-shaped
(C) U-shaped
(D) L-shaped

2. A normal human being has how many ear ossicle?

(A) 3
(B) 6
(C) 9
(D) None

3. Which one of the following is not included under ear ossicles -

(A) Malleus
(B) Ileum
(C) Incus
(D) Stapes

4. Human Cranium has small protuberance(s) at the posterior end called __________ and ____ in number. that articulates with first vertebra (atlas vertebra)-

(A) occipital condyle, 6
(B) occipital condyle, 2
(C) occipital condyle, 4
(D) occipital condyle, 3

5. Human skull is -

(A) Dicondylic
(B) Monocondylic
(C) Procoelous
(D) Hetercoelous

6. Human adult vertebral formula is-

(A) C4 T8 L4 S8 C8 (B) C7 T8 L5 S6 C7

(C) C7 T12 L2 S1 C2 (D) C7 T12 L5 S1 C1

7. Which of the following vertebra in adult human are fused ones?

(A) Thoracic and lumber (B) Thoracic and cervical

(C) Sacral and coccygeal (D) Cervical and coccygeal

8. Which of the following is not the function of vertebral column?

(A) Protects spinal cord and supports the head (B) Serves as the point of attachment for ribs and musculature of the back

(C) Both (D) Supports Tarsals and Metacarpals

9. Which of the following is not correct about sternum?

(A) It is commonly called breast bone (B) It is flat bone

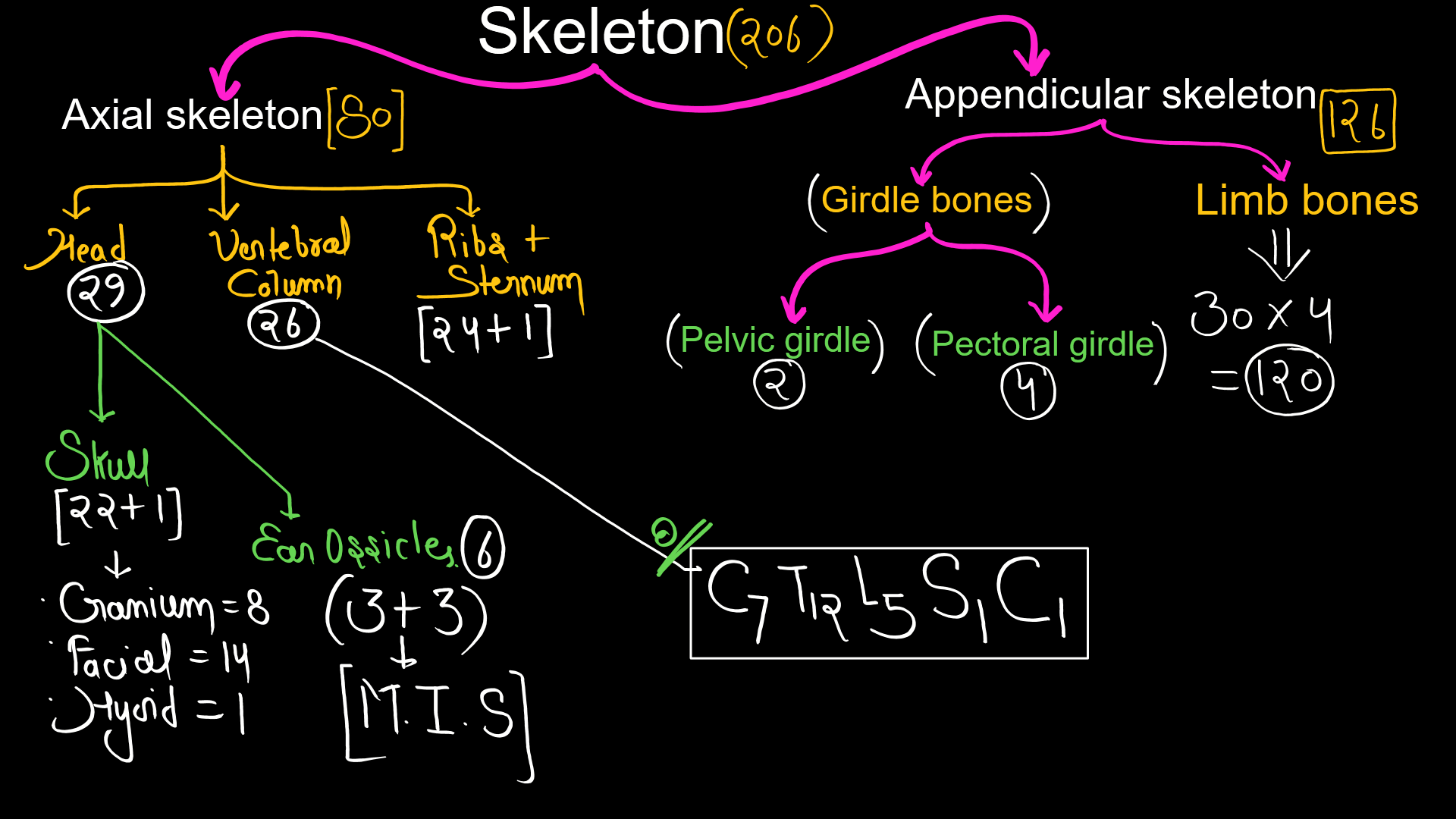
(C) It is 2 in number (D) It is located on the ventral mid line of thorax

10. Each typical rib is a thin flat bone connected ____ to the vertebral column and ___________ to the sternum-

(A) Dorsally, ventrally (B) Ventrally, dorsally

(C) Dorsally, dorsally (D) Ventrally, Ventrally

THANK YOU !!



Skeleton (206)
Axial skeleton [80]
Appendicular skeleton
126
Head
29
Vertebral Column
26
Ribs + Sternum
[24+1]
(Girdle bones)
Limb bones
(Pelvic girdle)
2
(Pectoral girdle)
4
30 x 4
= 120
Skull
[22+1]
Cranium = 8
Facial = 14
Hyoid = 1
Ear Ossicles 6
(3+3)
[M.I.S]
C7 T12 L5 S1 C1

Skull (22+1)

Cranium (8)

1) - Frontal = 1
2) - Parietal = 2
3) - Temporal = 2
(Parietal and Temporal: Paired)
4) - Occipital = 1
5) - Sphenoid = 1
6) - Ethmoid = 1

Facial (14)

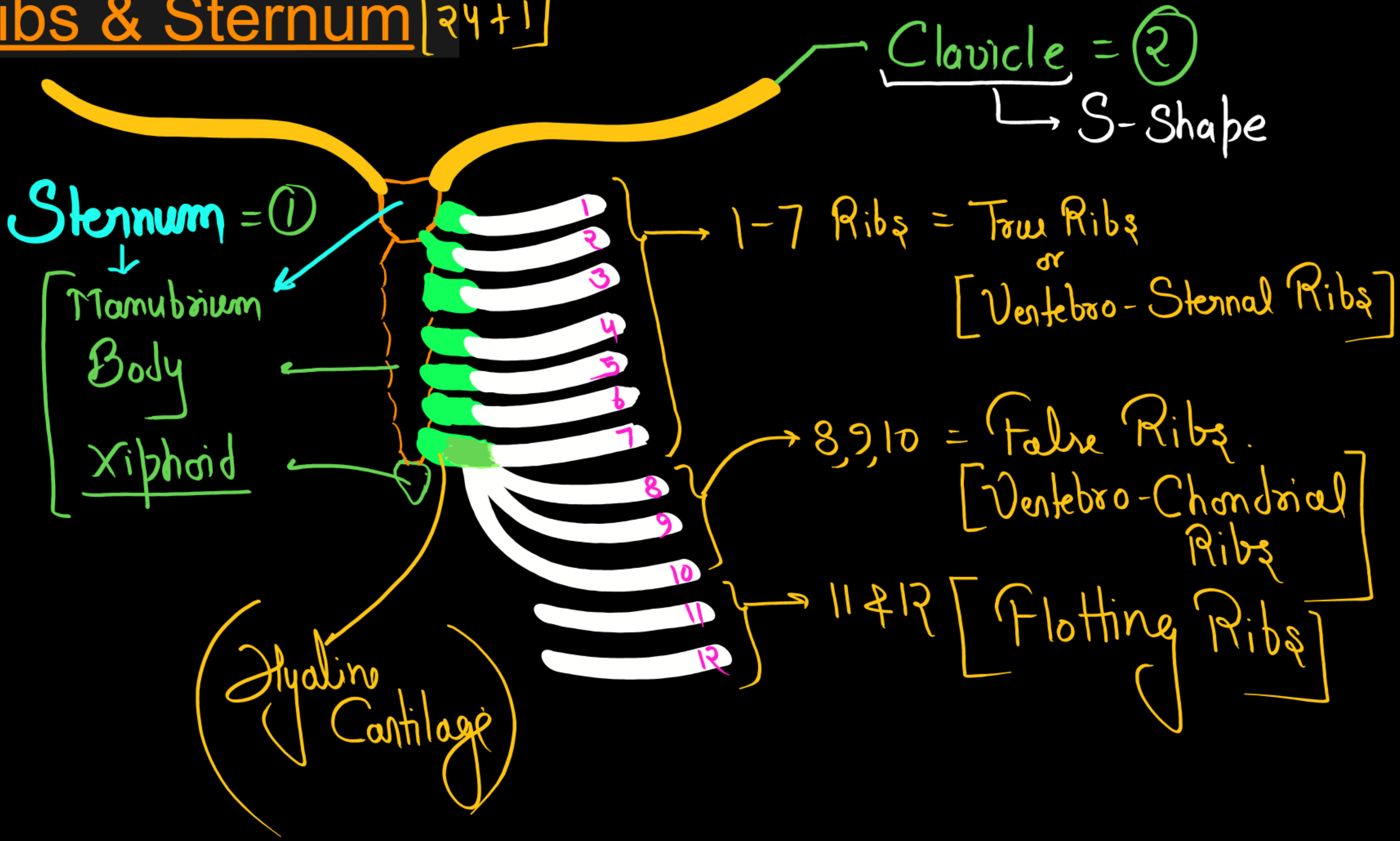
1 - Lacrimal = 2
2 - Zygomatic = 2
3 Nasal = 2
4 Inferior Conchae = 2
5 - Vomer = 1
6 - Maxillary = 2
7 - Palatine = 2
8 - Mandible = 1

(Vomer and Mandible: unpaired)

Hyoid (1)

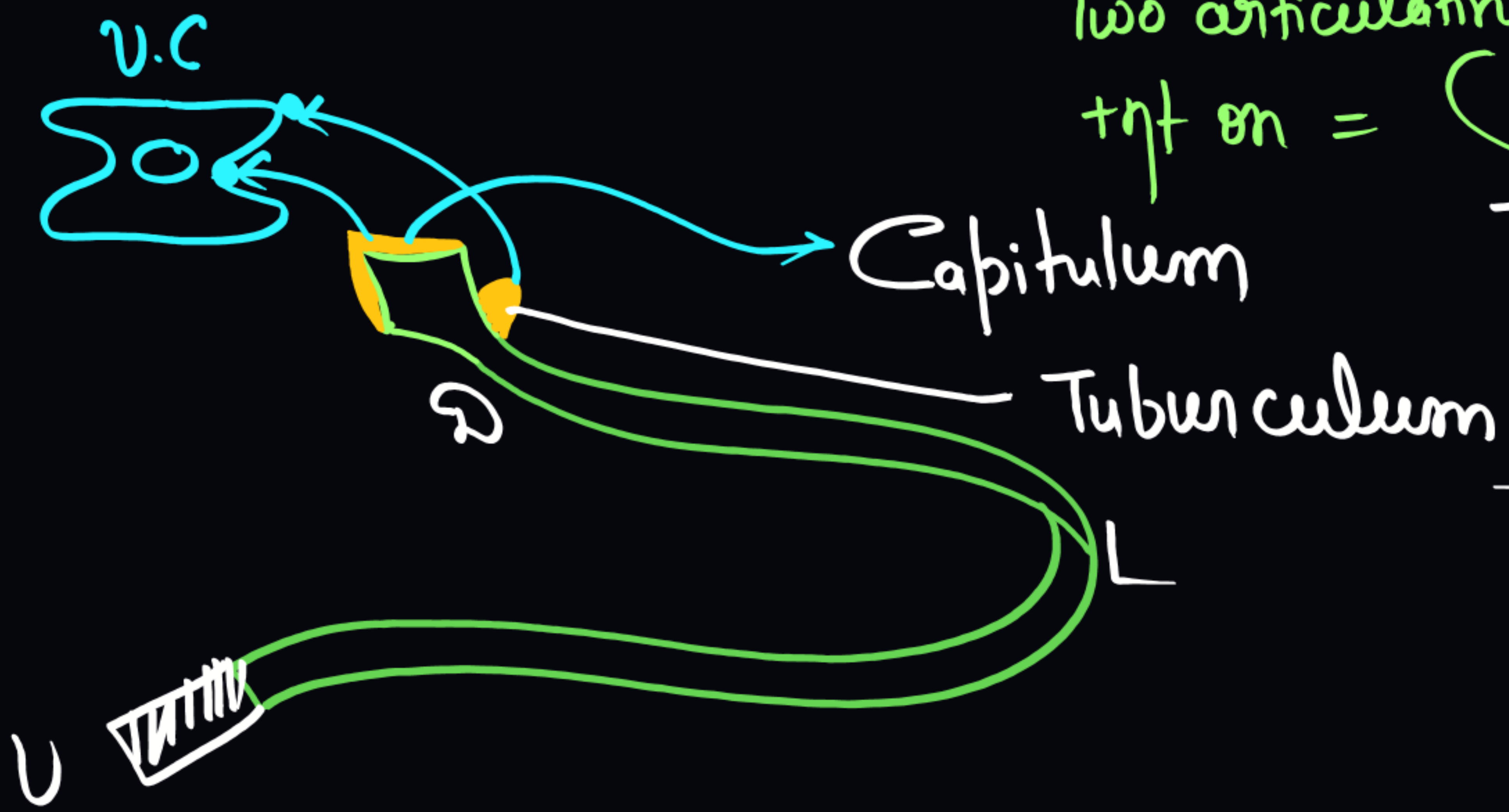
(U-Shape)

Ribs & Sternum [24+1]



Biaphalic Ribs ⇒ Human Ribs are Biaphalic

Two articulating Surface tnt on = Dorsal Side.



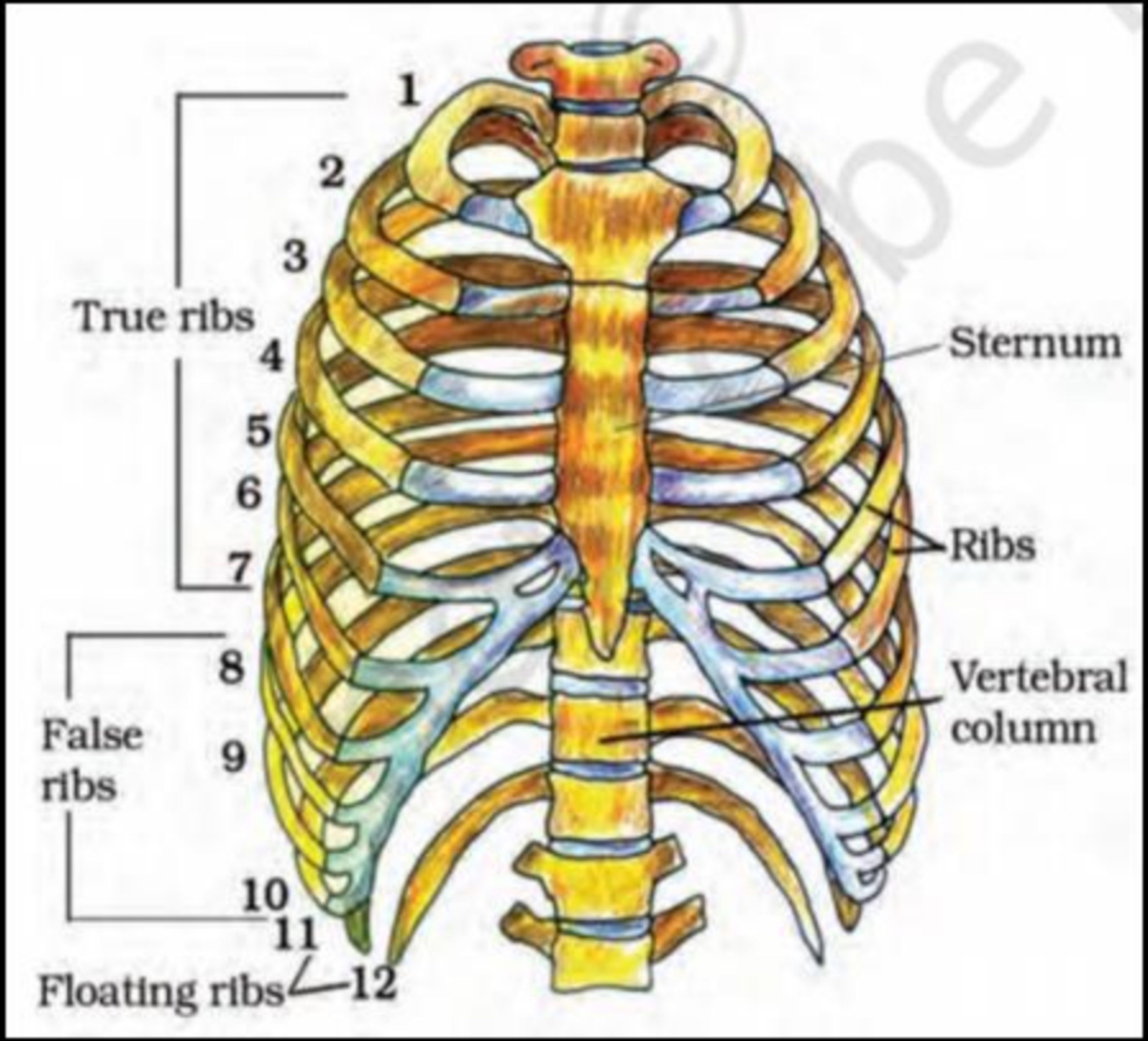
= Two articulating Surface on Dorsal Side.

Rib Cage =

Ventral = Sternum

Dorsal = V. Column

Lateral = Ribs

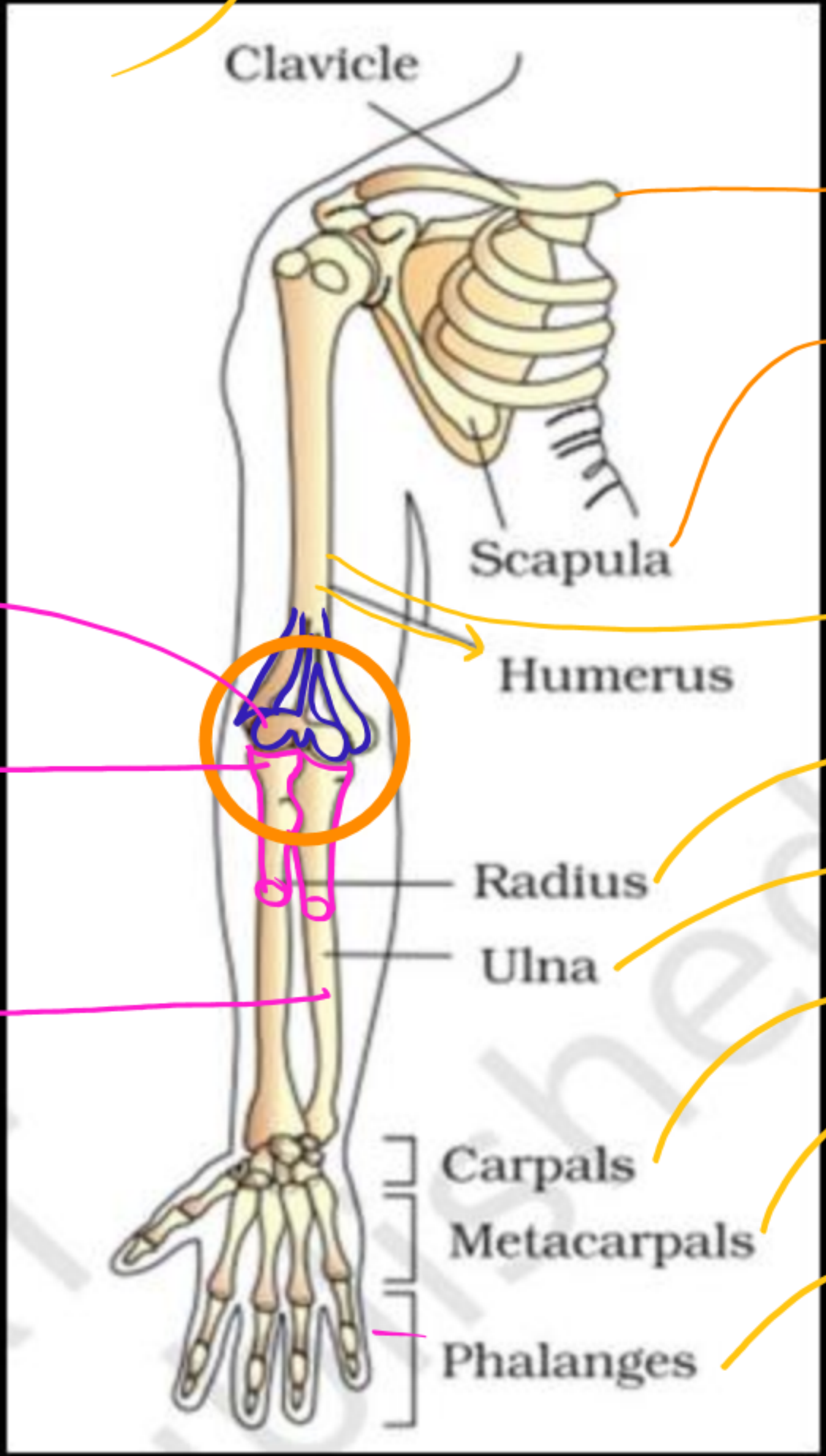


Limbs Bones

= (30+30 = 60)

Hinge joint

Humerus
Radius
+
Ulna



Clavicle + Sapula } Half Pectoral Girdle
② + ② = ④

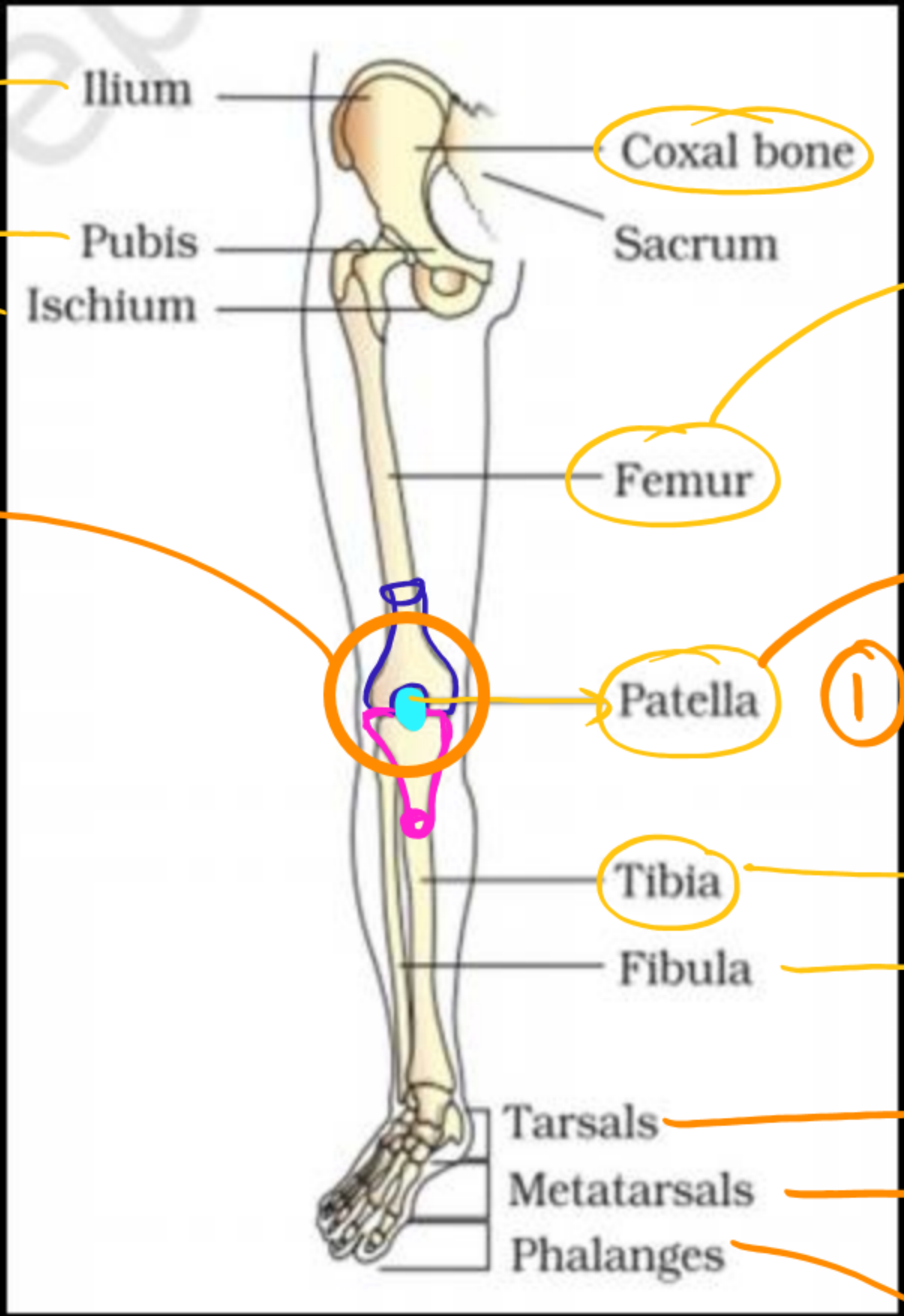
Humerus = ①
Radius = ①
Ulna = ①
Carpals = ⑧
Metacarpals = ⑤
Phalanges = ⑭
3+3+3+3+2

Coxal bone { Ilium, Pubis, Ischium

⇓

Half of Pelvic (1)

[30+30=60]



Femur = 1

Patella (1) → Form by ossification of Tendon

(Hinge joint) → (Femur + Tibia)

Tibia = 1

Fibula = 1

Tarsal = 7

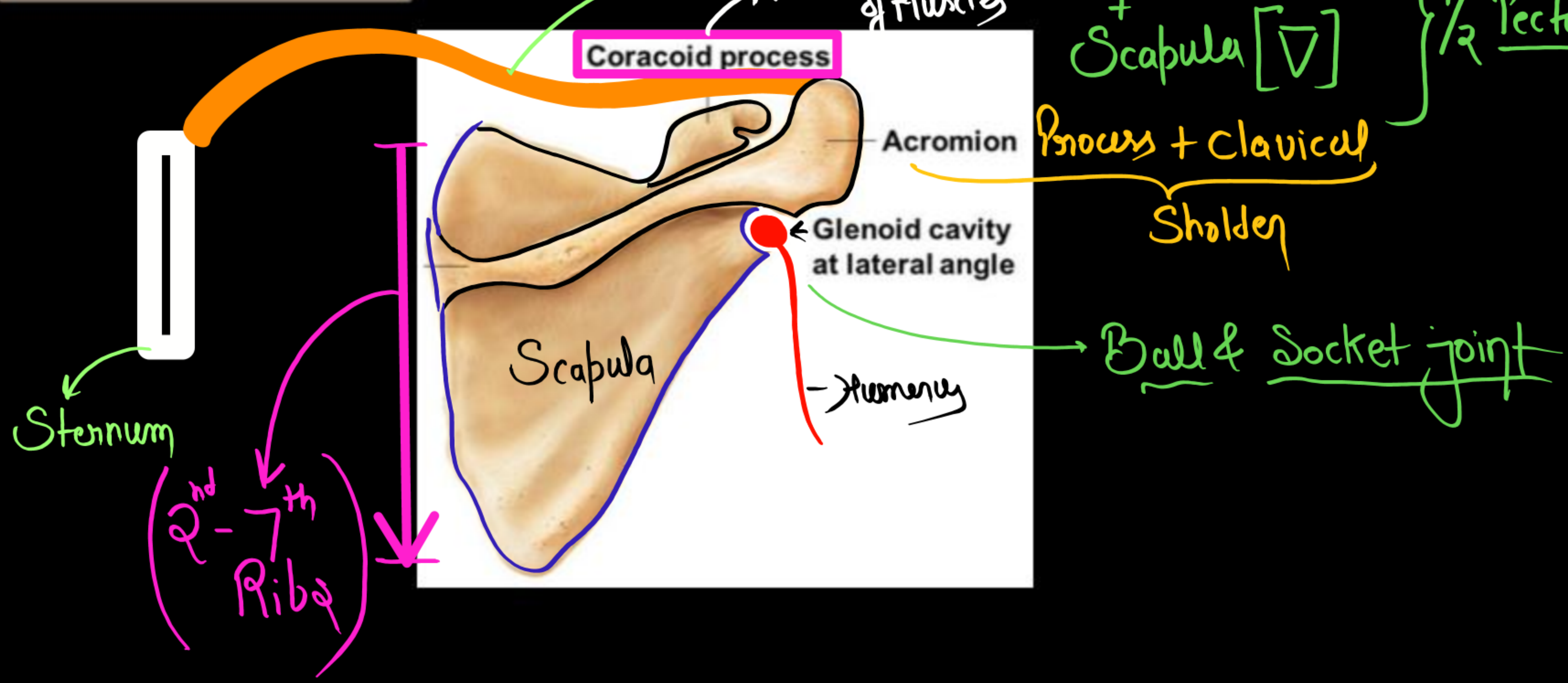
Metatarsal = 5

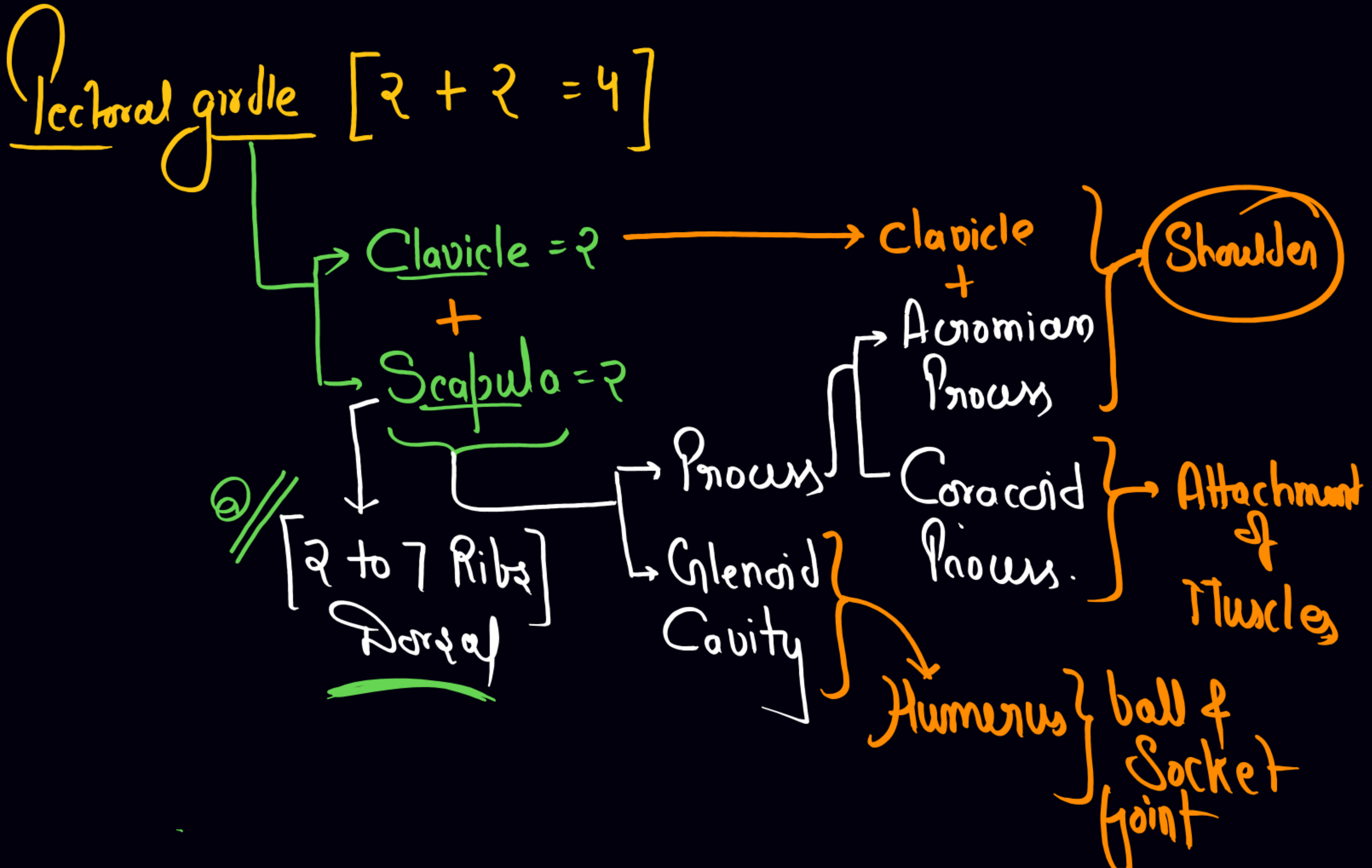
Phalanges = 14

Pectoral Girdle

= [2+2 = 4]

Clavical [S-Shape] + Scapula [∇] } 1/2 Pectoral

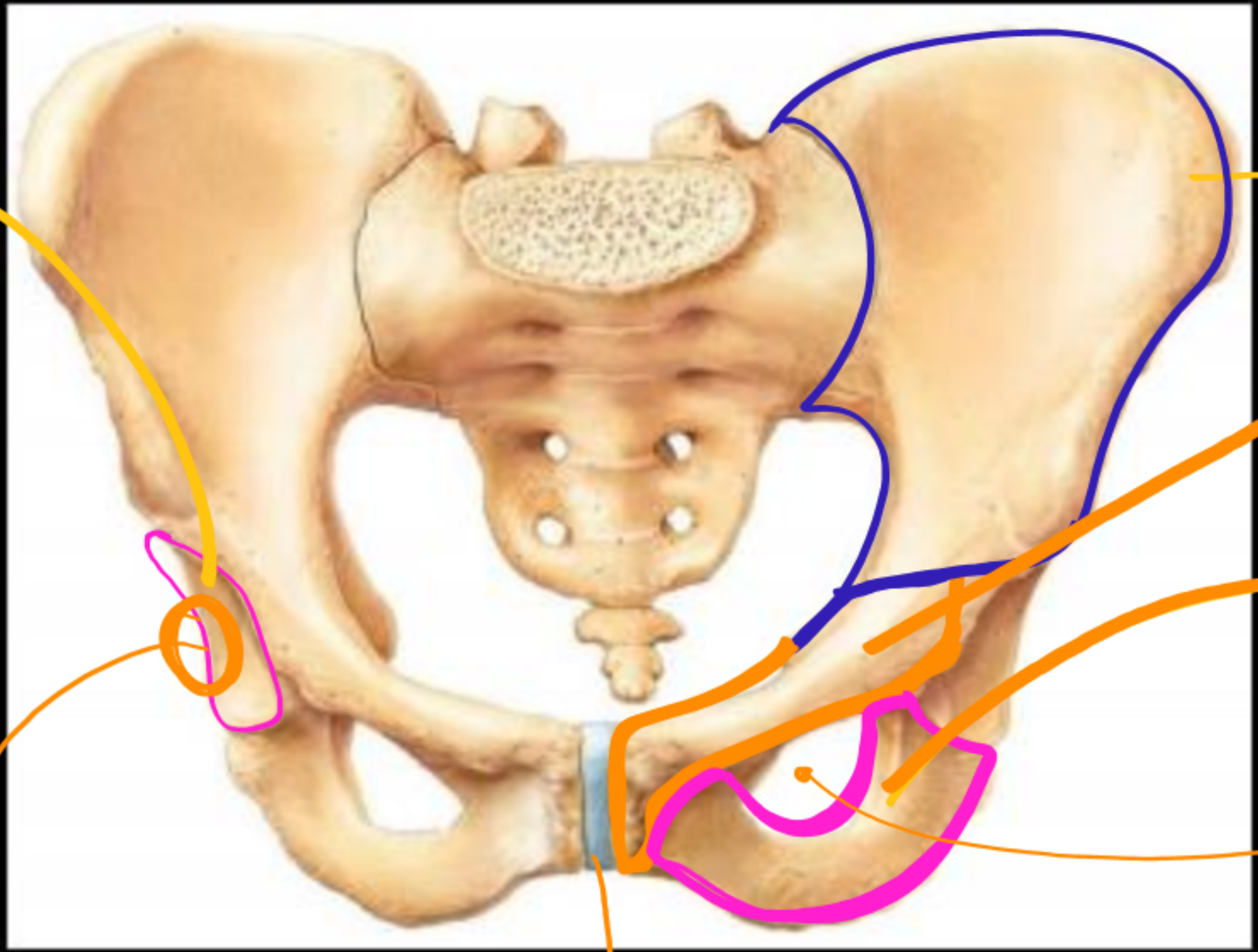



Pectoral girdle [2 + 2 = 4]
Clavicle = 2
+
Scapula = 2
Clavicle
+
Acromian Process
Shoulder
Process
Coracoid Process.
Attachment of Muscles
Glenoid Cavity
Humerus
ball & Socket Joint
@ [2 to 7 Ribs] Dorsal

Pelvic Girdle

= 1+1 = 2

[Acetabulum]
↓
{Ilium + Ischium + Pubis}



Ilium (Largest)
Pubis (Smallest)
Ischium
} Coxal Bone ⇓ ½ of Pelvic

Obturator foramen ⇓ (Pubis + Ischium)

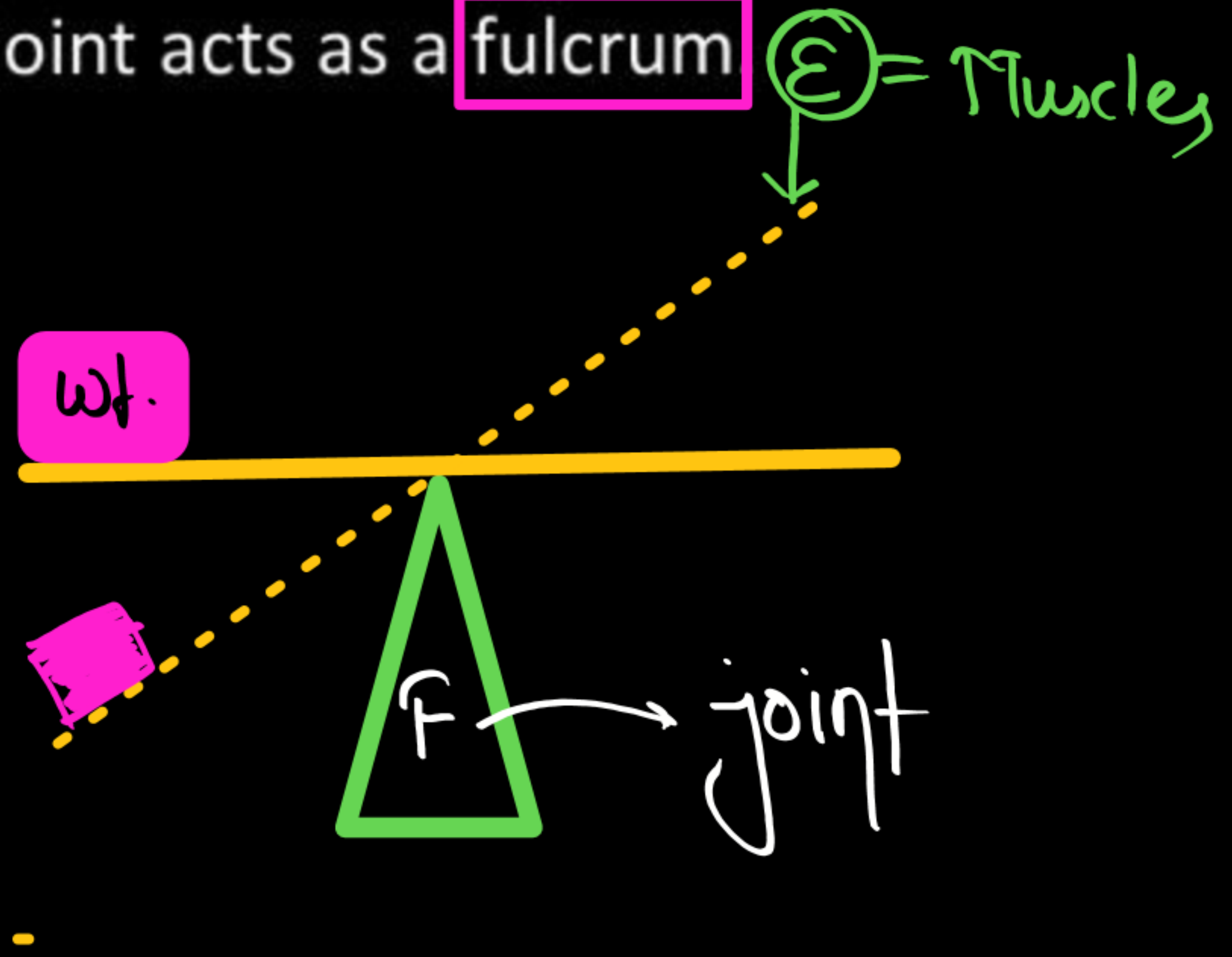
Femur ⇓ Ball & Socket joint

Relaxin Hormone → (Pubic Symphysis)

Joints

Joints are points of contact between bones, or between bones and cartilages.

Force generated by the muscles is used to carry out movement through joints, where the joint acts as a fulcrum.

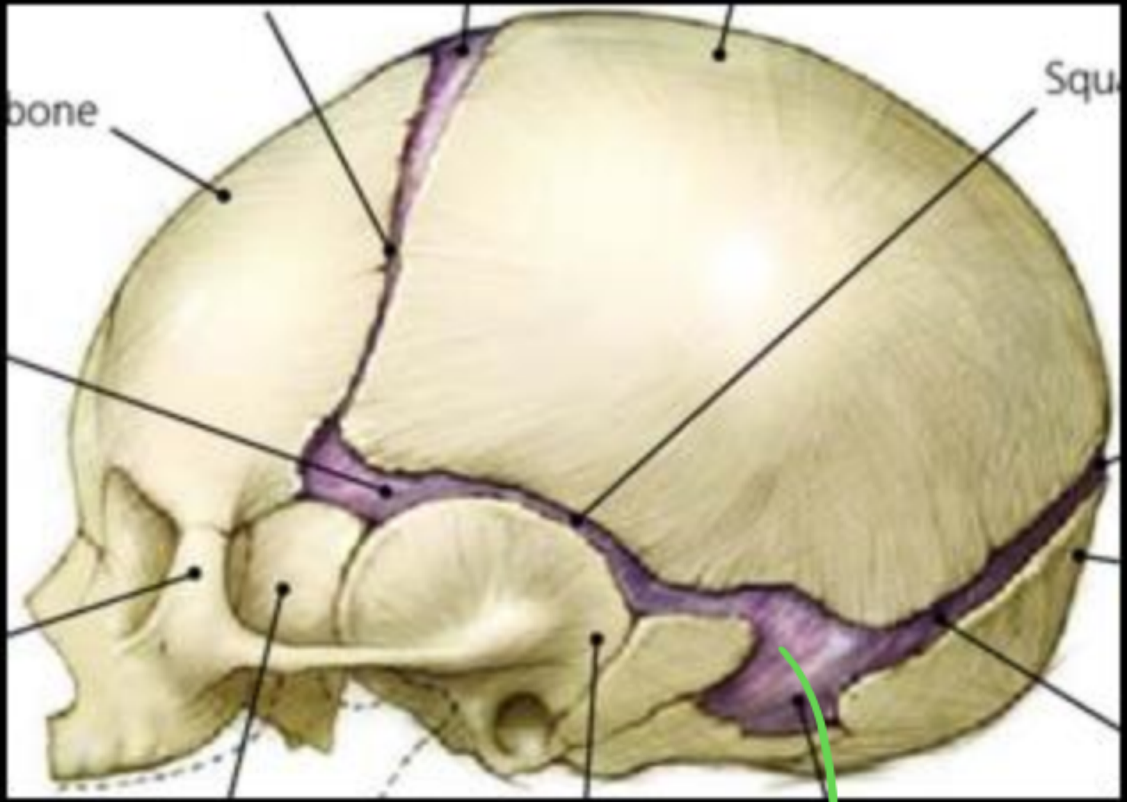


Joints have been classified into

1. [Fibrous joint] (Immovable)
   - eg - Sutures of Skull

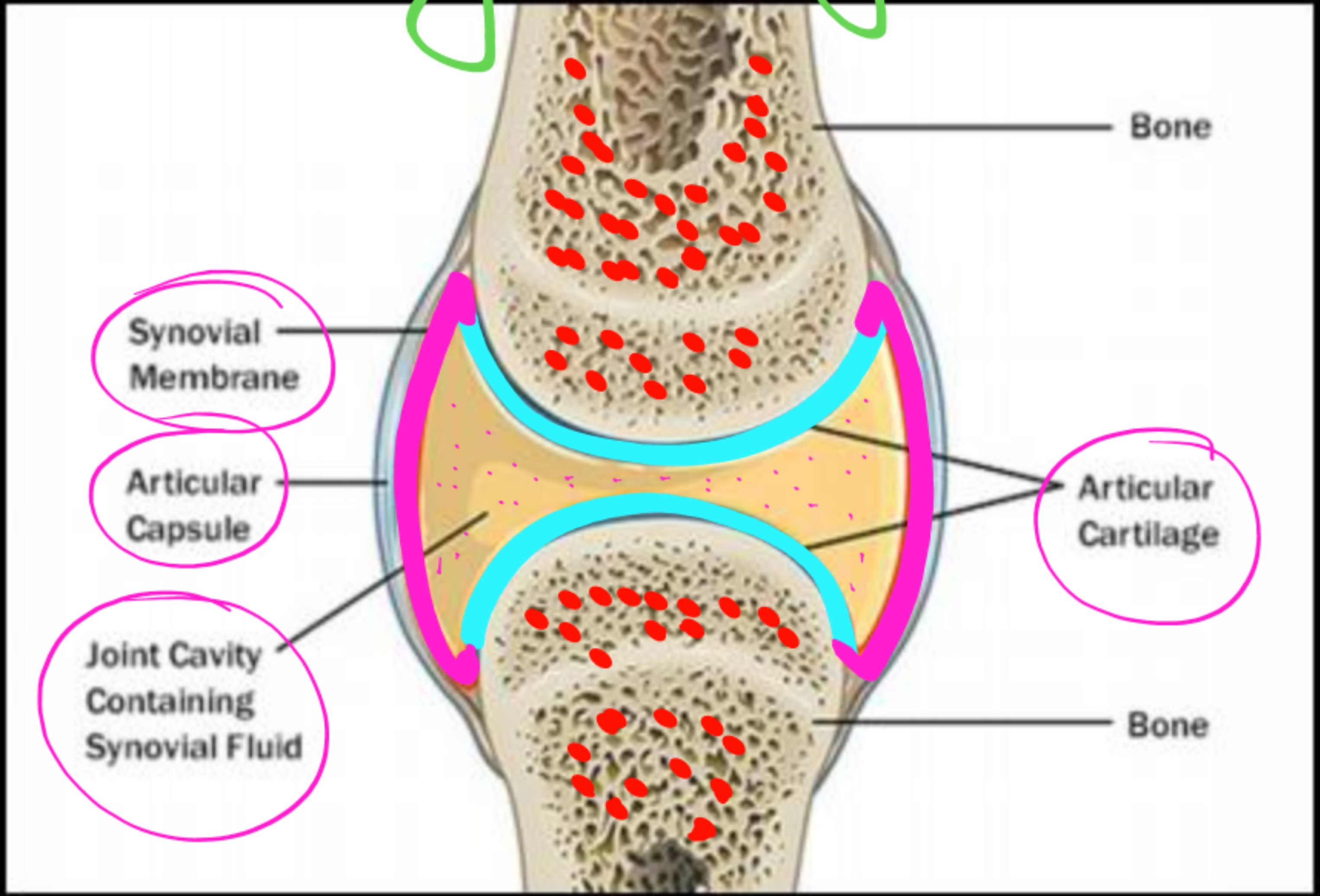
2. [Cartilagenous joint] [Semimovable]
   - eg - Intervertebral Disc
   - Pubic Symphysis
   - joint b/w Sternum & Ribs.

3. [Synovial joint] (Movable)
   - ↓ *



[Sutures] in (Skull)

Synovial joint



Synovial joints are characterized by the presence of a fluid filled synovial cavity between the articulating surfaces of the two bones.

1. Ball and socket joint - Shoulder & Hip joint
2. Hinge joint - Elbow, Knee, b/w Phalinges.
3. Pivot joint - b/w Atlas & Axis
4. Gliding joint - b/w Carpas & b/w tarsals → Metacarpal & phalin.
5. Condyloid/Ellipsoid - b/w Skull & Atlas b/w → Metatarsal & phalin.
6. Saddle joint - between carpal and metacarpal of thumb

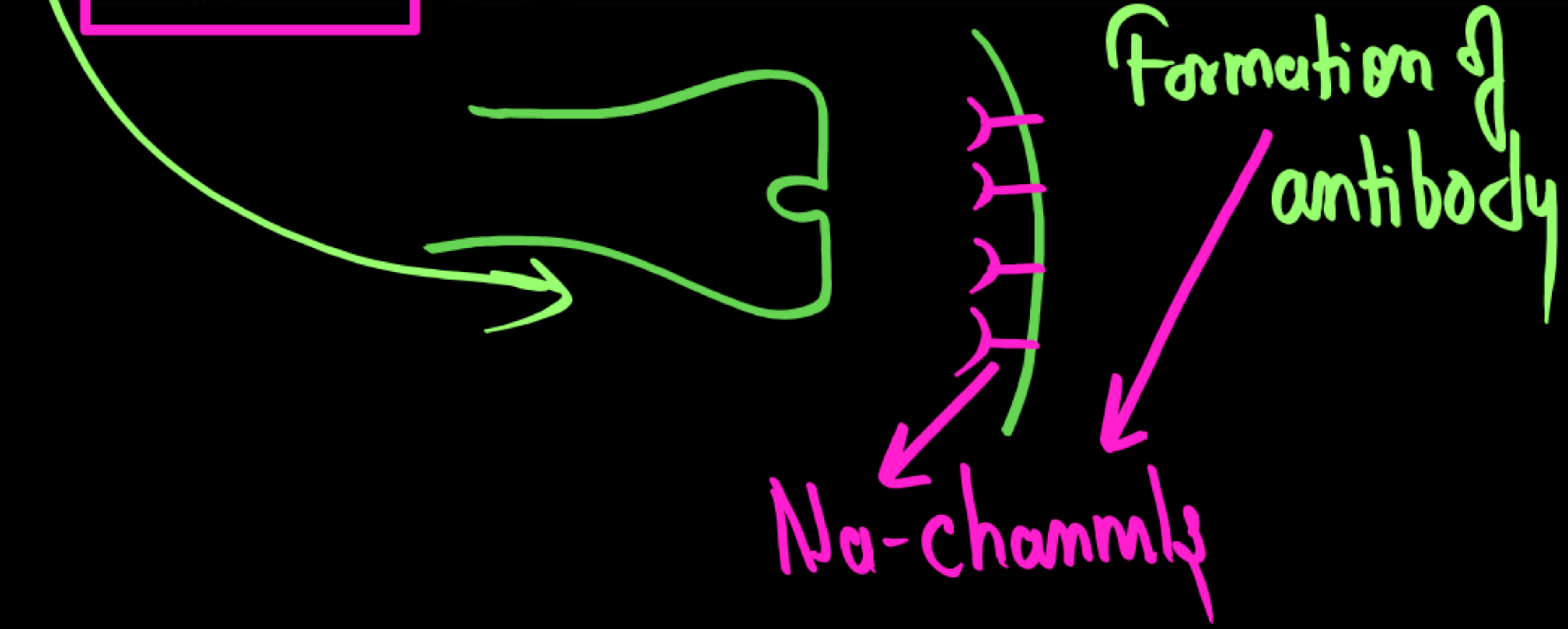
Disorders

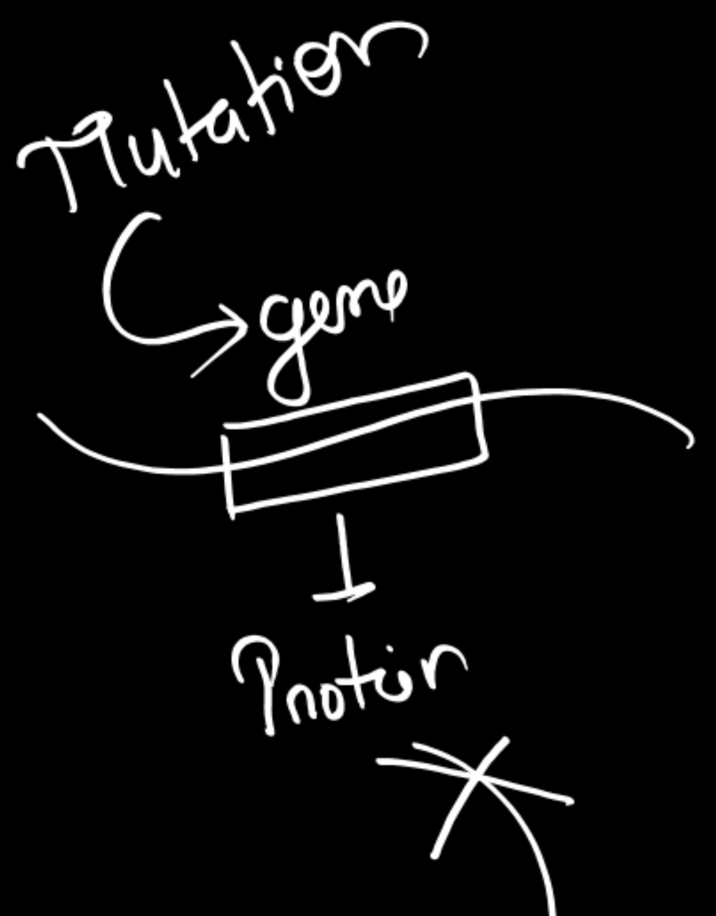
20.5 Disorders of Muscular and Skeletal System

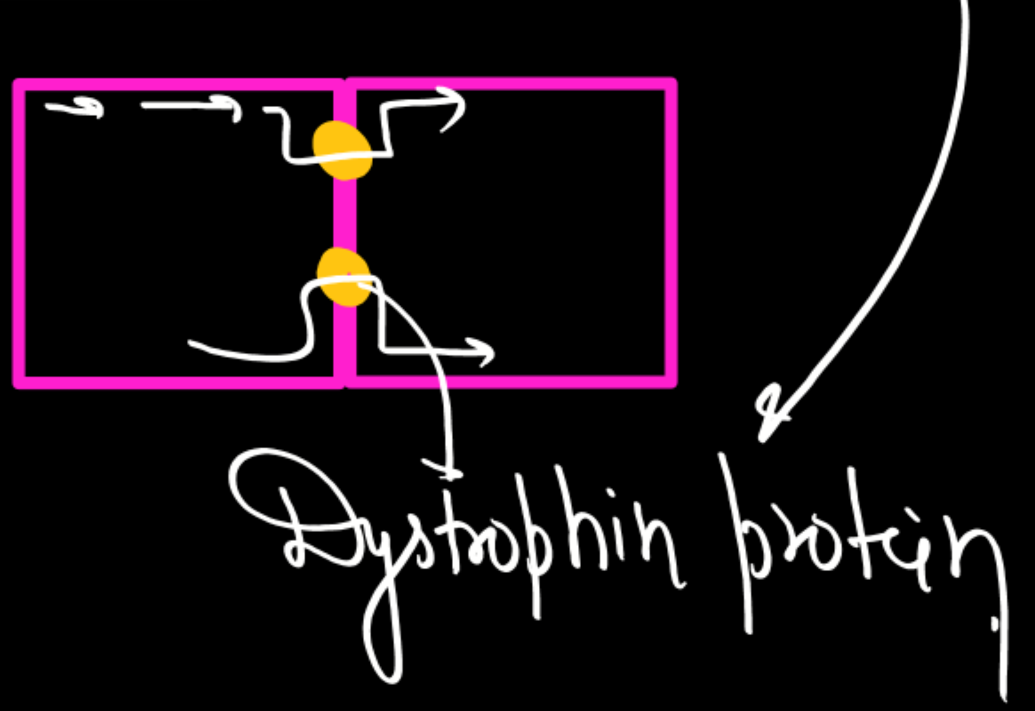
Myasthenia gravis: Auto immune disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscle.

Muscular dystrophy: Progressive degeneration of skeletal muscle mostly due to genetic disorder.

Tetany: Rapid spasms (wild contractions) in muscle due to low Ca^{++} in body fluid.







Arthritis: Inflammation of joints.

Osteoporosis: Age-related disorder characterised by decreased bone mass and increased chances of fractures. Decreased levels of estrogen is a common cause.

Gout: Inflammation of joints due to accumulation of uric acid crystals.

MANTHAN NEET 2025

LOCOMOTION AND MOVEMENT

LECTURE - 5

ZOOLOGY



MD SIR

SANKALP NEET VEDANTU

❑ TODAY'S GOAL -

- ❑ Human Skeletal System -2

Ribs and Sternum

= [24 + 1]

Clavicle [1+1] = Part of Pectoral Girdle. (S-shape)

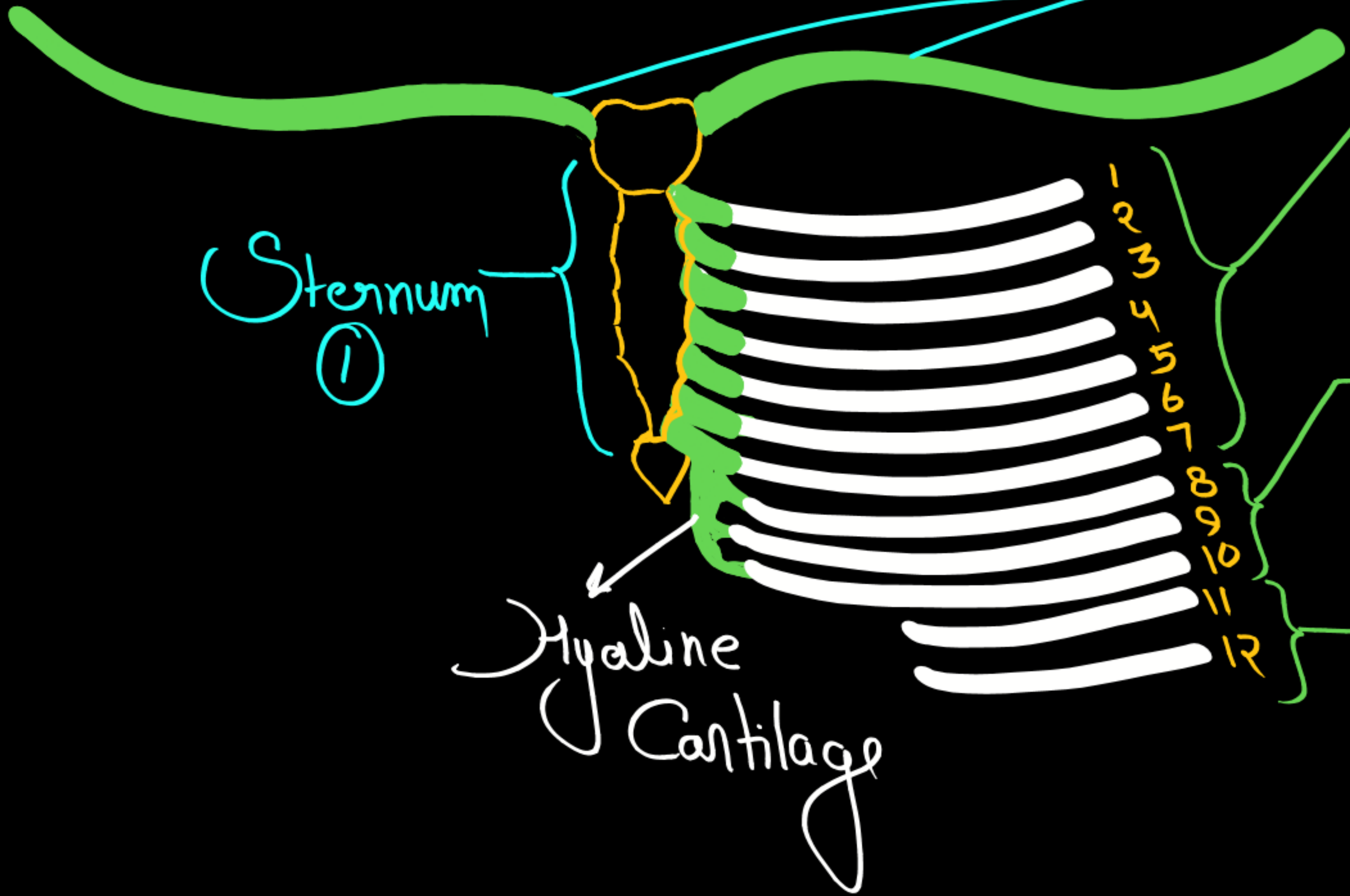
1-7 = True Ribs (14)

Imp [Vertebro- or Sternal Ribs]

8-10 = False Ribs (6)

Imp [Vertebro- Chondrial Ribs]

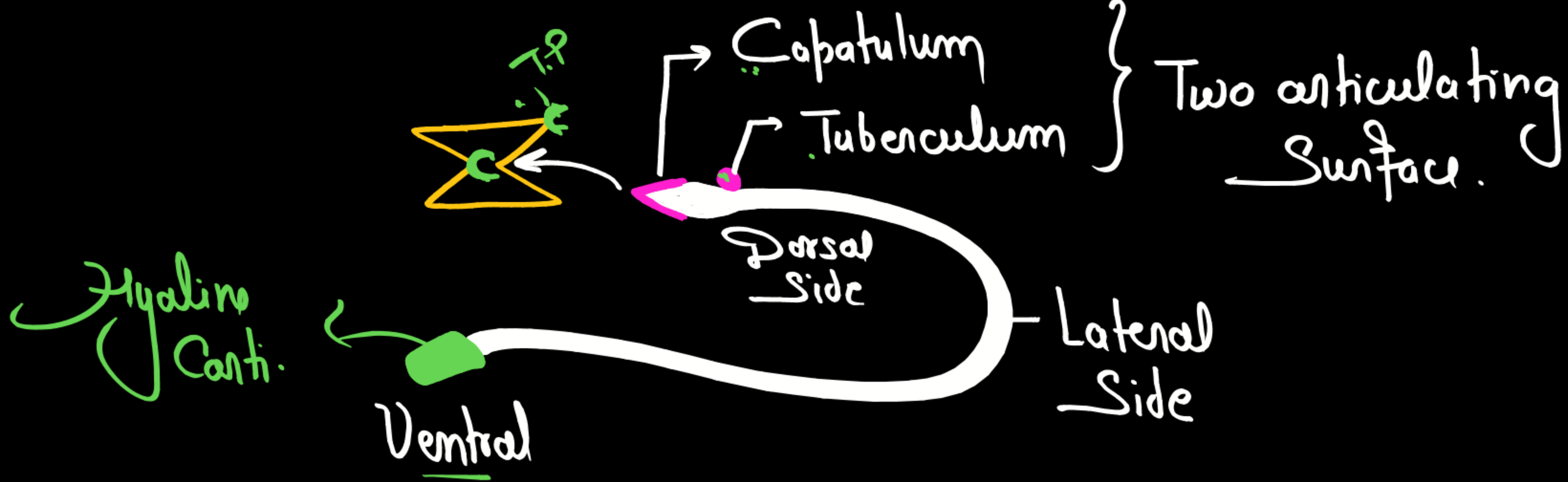
11 & 12 = Floating Ribs (4)



Bicephalic Ribs :→

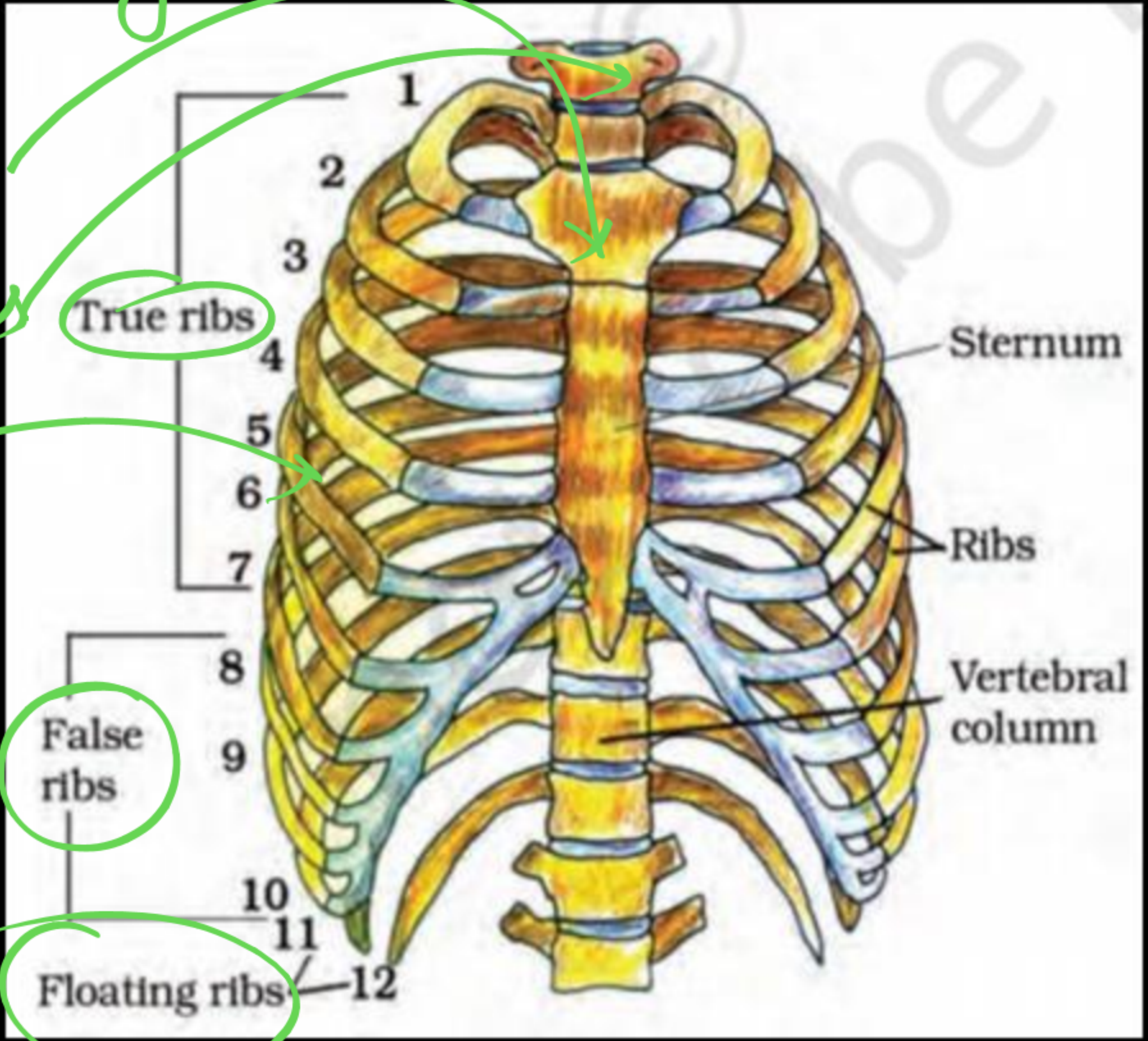
Imp

Human Ribs have = Two articulating Surface on dorsal Side



Rib-Cage (Thoracic Cage)

Ventral = Sternum
Dorsal = V. Columns
Lateral = Ribs



Limbs Bones

$(H_1 R_1 U_1 C_8 MC_5 P_{14} = 30)$

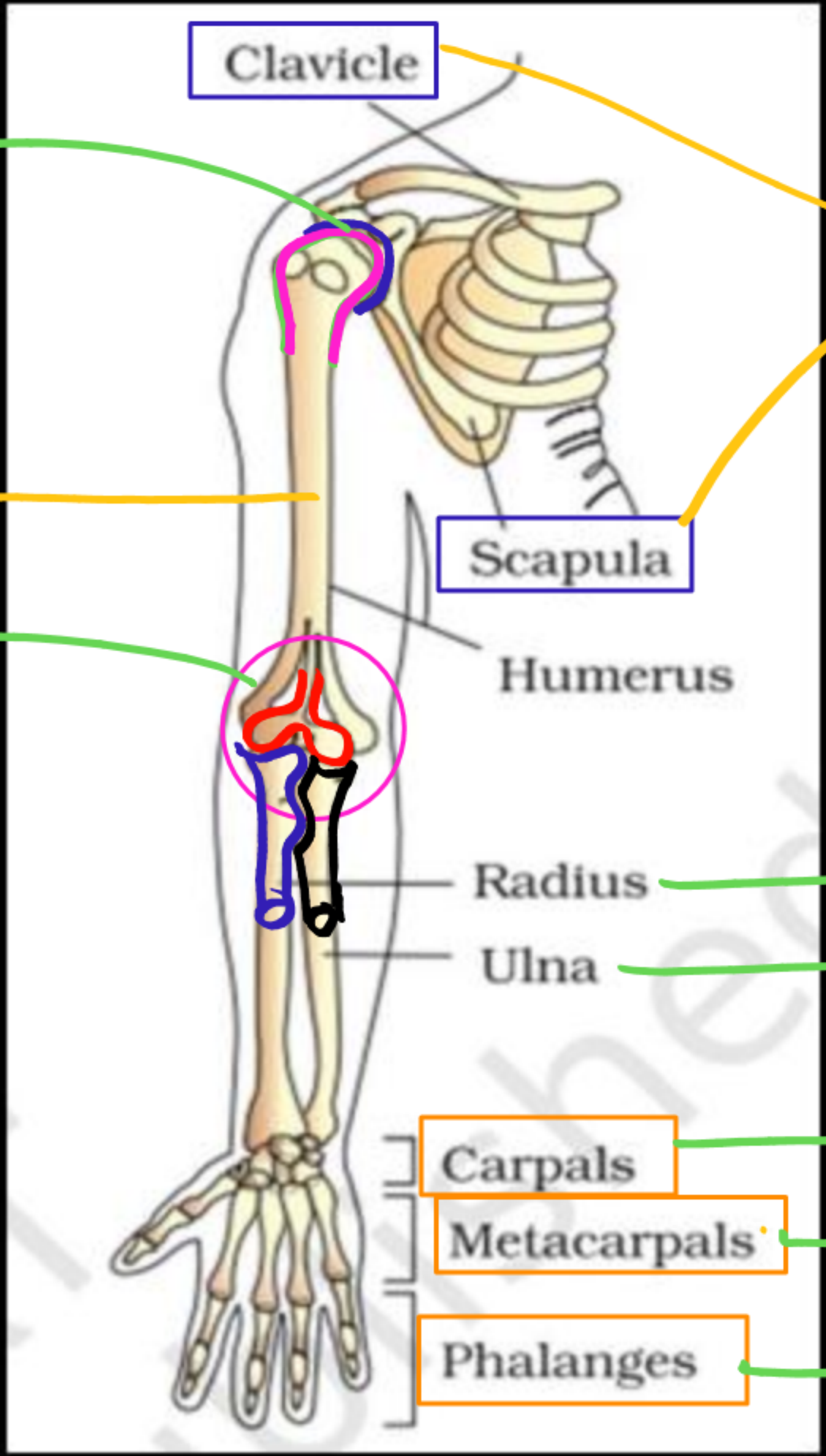
Ball & Socket joint

$\frac{1}{2}$ Pectoral Girdle

Humerus ①

Hinge joint

[Humerus + Radius + Ulna]



Radius - ①

Ulna - ①

Carpals - ⑧

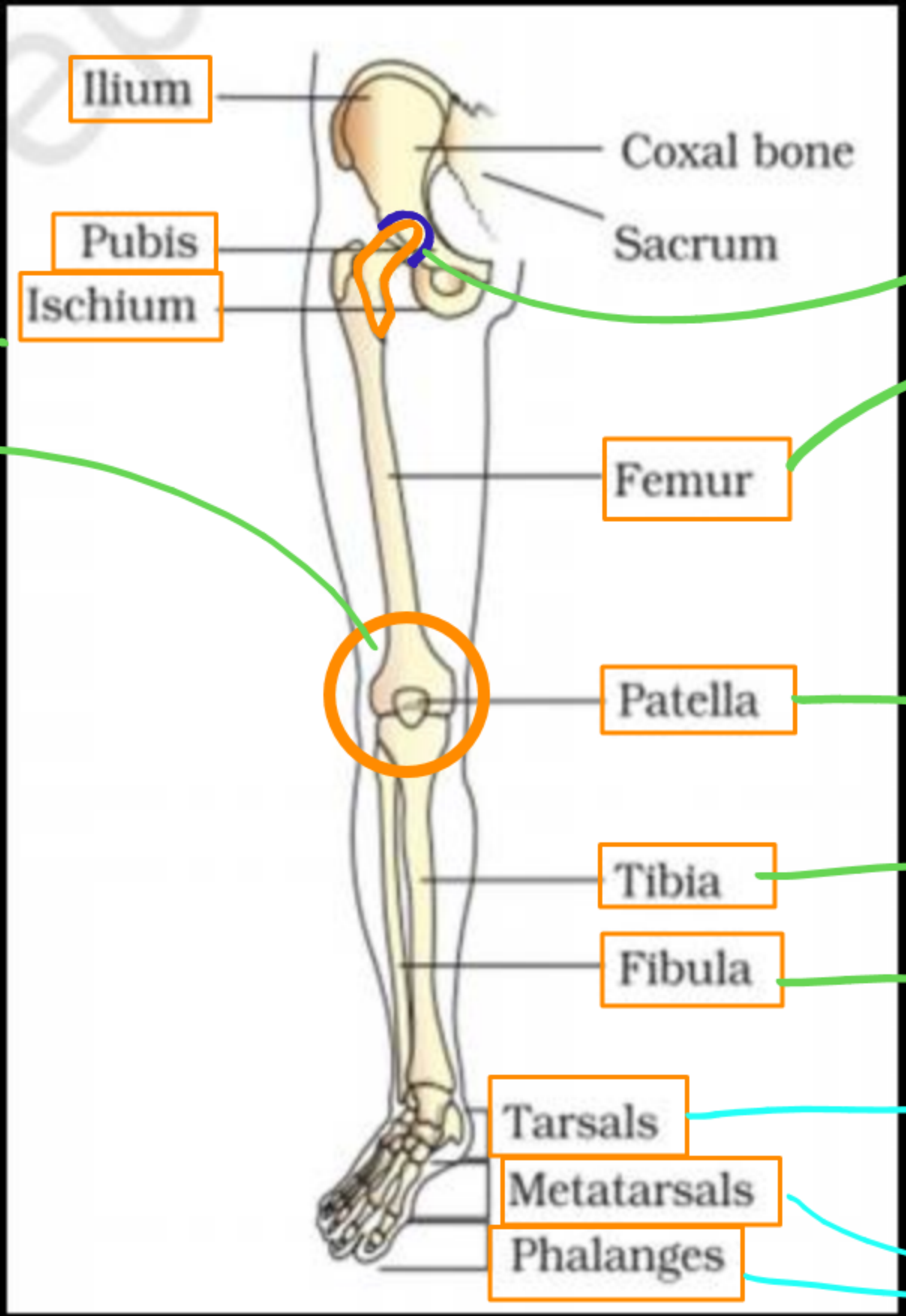
Metacarpals - ⑤

Phalanges → 3+3+3+3+1 = ⑭

1/2 Pelvic Girdle
⇓
(Coxal bone)

Ball & Socket joint

Hinge joint
↓
(Femur + Tibia)



Femur → 1

Patella → 1 = form by Ocification of Tendon

Tibia → 1

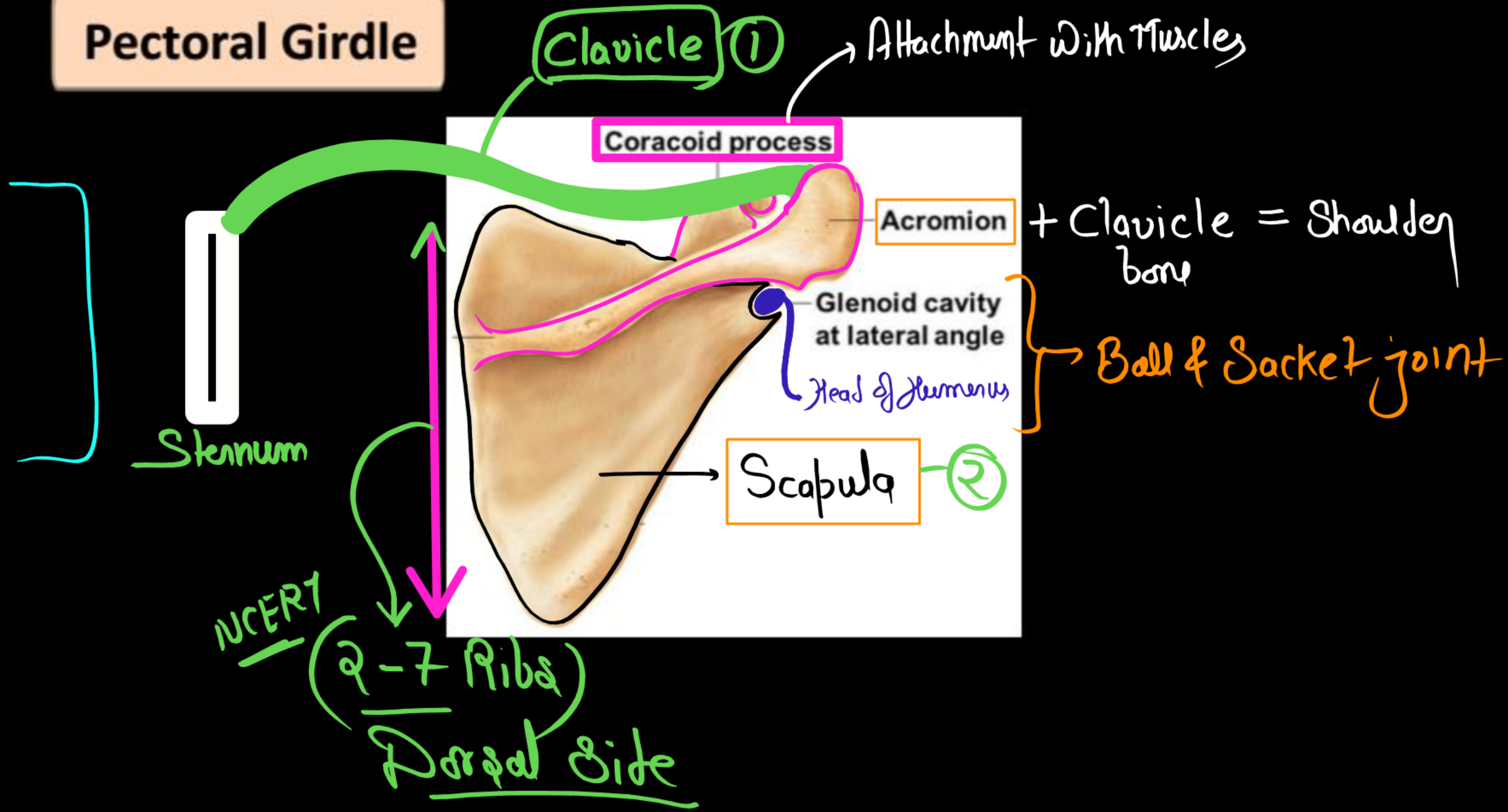
Fibula → 1

Tarsals → 7

Metatarsals → 5

Phalanges → 3+3+3+3+2 = 14

Pectoral Girdle



$\frac{1}{2}$ = Pectoral Girdle

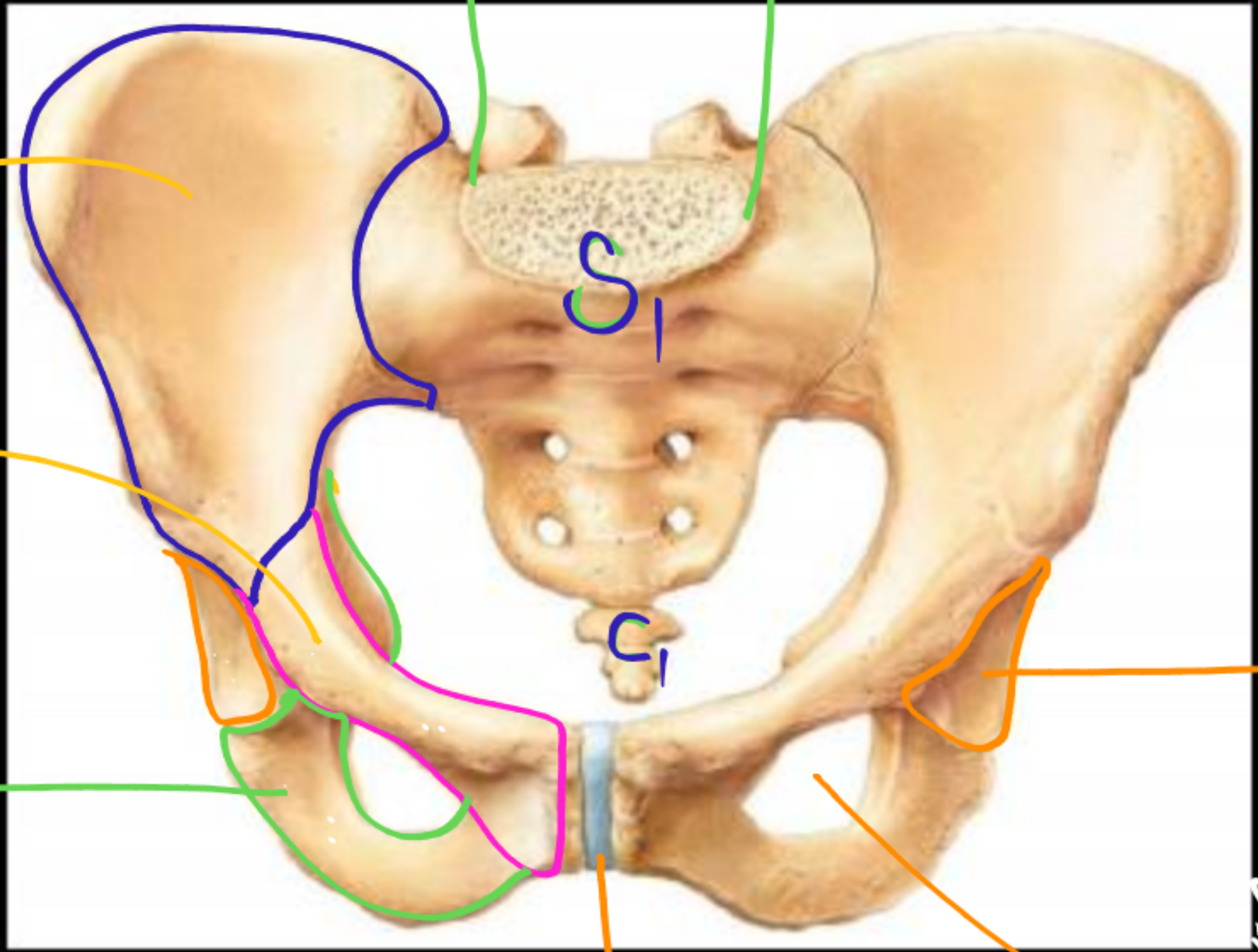
- Clavical bone (Collar bone)
- +
- Scapula
  - Coracoid Process = attachment of Mus.
  - Acromian Process
    - Formation of Shoulder with clavicle.
  - [Cover = 2-7 Ribs on dorsal site]
  - [Glenoid Cavity]

Pelvic Girdle

= (2 Coxal bone)

Coxal bone = Ilium (L) + Pubis (S) + Ischium

Coxal bone → (½ of Pelvic)



vvImp — Acetabulum Cavity [Ilium + Ischium + Pubis]

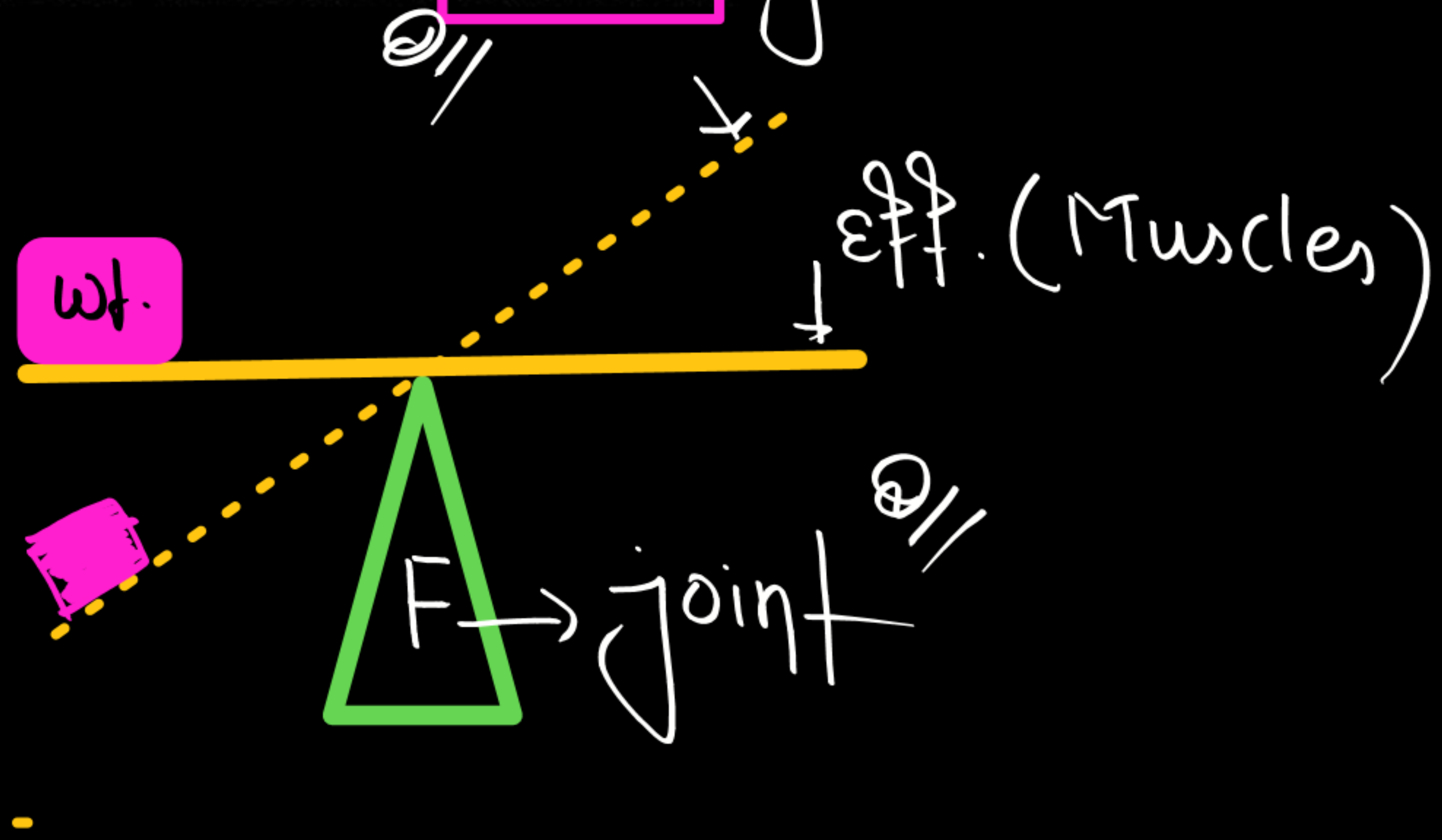
vvImp — Obturator foramen [Ischium + Pubis]

Cartilage [Pubicsymphysis]

Joints

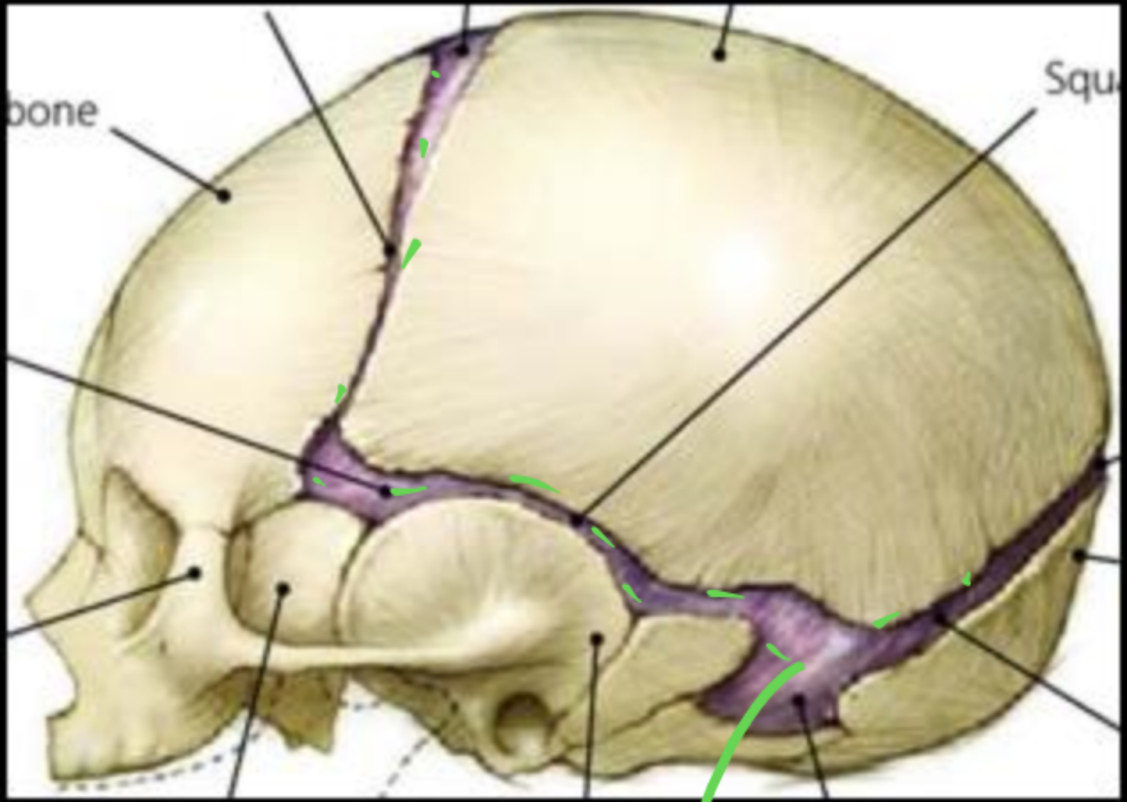
Joints are points of contact between bones, or between bones and cartilages.

Force generated by the muscles is used to carry out movement through joints, where the joint acts as a fulcrum



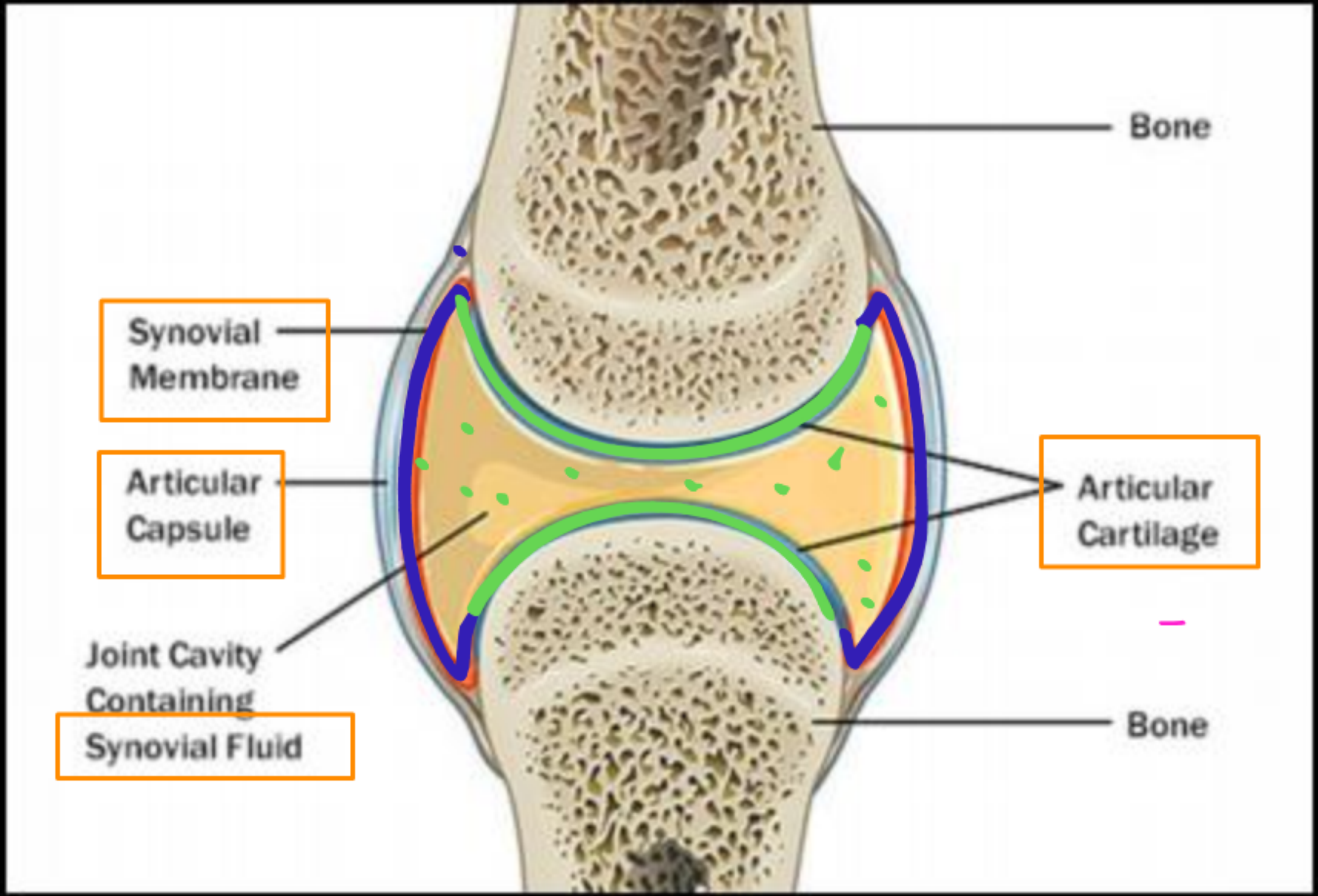
Joints have been classified into -

- [Fibrous] [Immovable]
  - eg - Sutures (Jnt in Skull) [Deposition of Collagen fibres]
- [Cartilagenous] (Semimovable)
  1) - Intervertebral Disc
  2) - Pubic Symphysis
  3) → Jnt b/w Ribs & Sternum
- [Synovial joint] [Movable]
  - *



[Sutures]
+
Collagen fibres

Synovial joint.



Synovial joints are characterized by the presence of a fluid filled synovial cavity between the articulating surfaces of the two bones.

1. Ball and socket joint → shoulder & Hip joint
2. Hinge joint - Knee joint, Elbow joint, b/w phalanges.
3. Pivot joint - b/w Atlas & Axis, Radius & Ulna.



4. Gliding joint - b/w Carpals & b/w Tarsals
5. Condyloid/Ellipsoid - b/w Skull & Atlas, Meta carpal & Phalanges. Metatarsal & " "
6. Saddle joint - between carpal and metacarpal of thumb

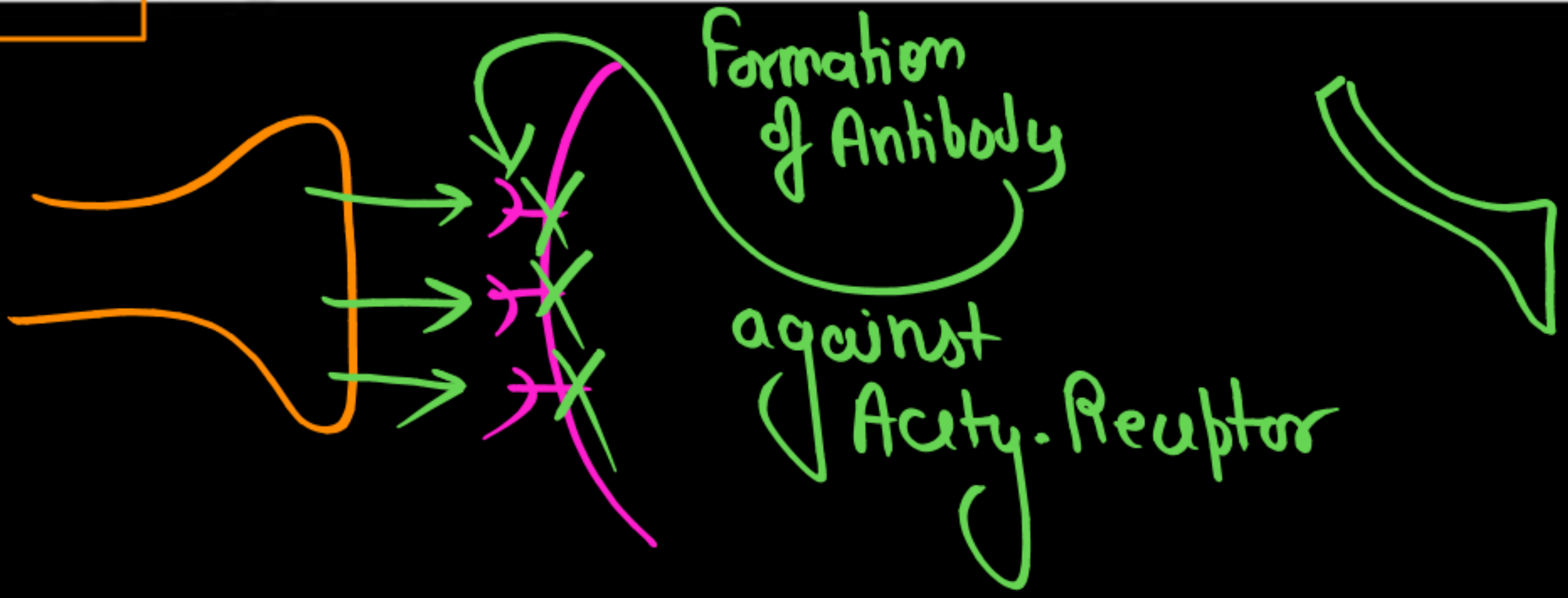
Disorders

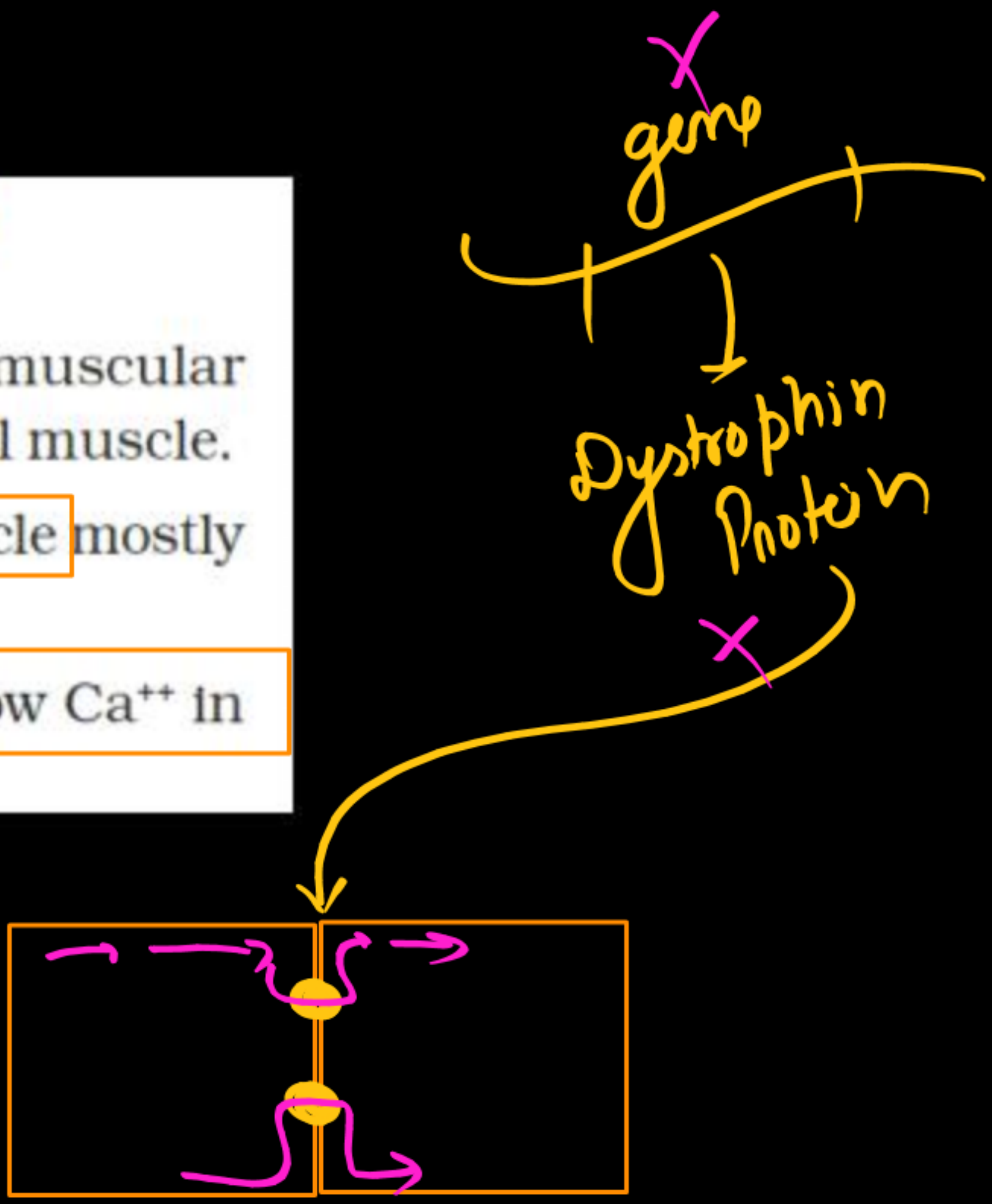
20.5 Disorders of Muscular and Skeletal System

Myasthenia gravis: Auto immune disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscle.

Muscular dystrophy: Progressive degeneration of skeletal muscle mostly due to genetic disorder.

Tetany: Rapid spasms (wild contractions) in muscle due to low Ca^{++} in body fluid.





Arthritis: Inflammation of joints.

Osteoporosis: Age-related disorder characterised by decreased bone mass and increased chances of fractures. Decreased levels of estrogen is a common cause.

Gout: Inflammation of joints due to accumulation of uric acid crystals.

H.W.

12. Typical ribs are -

(A) Monocephalic
(B) Dicephalic
(C) Tricephalic
(D) Tetracephalic

13. Which of the following ribs are called vertebrochondral ribs?

(A) True ribs
(B) False ribs
(C) Gorilla ribs
(D) Floating ribs

14. Rib cage is formed by all except -

(A) Thoracic vertebrae
(B) Lumbar vertebrae
(C) Ribs
(D) Sternum

15. Each limb (upper or lower) consists of how many bones –

(A) 30
(B) 60
(C) 101
(D) 8

16. Pelvic girdle (hip girdle) is composed ____ coxal (hip) bones-

(A) 3 (B) 2

(C) 4 (D) 5

17. Pelvic girdle consists of-

(A) Ileum, ischium and pubis

(B) Ilium, ischium and pubis

(C) Ilium, ischium and clavicle

(D) Coracoid, ischium and pubis

18. Two halves of pelvic girdle articulate ventrally at a fibrocartilaginous joint called -

(A) Pubic symphysis

(B) Synchodroses

(C) Gomphoses

(D) Sutures

19. Each coxal bone is formed by the fusion of 3 bones named as -

(A) Ileum, ischium and pubis

(B) Ilium, ischium and pubis

(C) Ilium, ischium and clavicle

(D) Coracoid, ischium and pubis

20. Joint between bones in the form of sutures of human skull is -

(A) Hinge joint (B) Synovial joint

(C) Cartilaginous joint (D) Fibrous joint

21. Which of the following statements is correct?

(A) Movable skull bone is mandible

(B) We move our hands while walking for balancing

(C) Cartilaginous joints have little mobility due to fibrocartilage disc between its articular ends e.g. intervertebral disc between centre of vertebrae

(D) All

22. A disease associated with joint is -

(A) Glaucoma (B)Arthritis

(C) Paget's disease (D) Homer's syndrome

23. Gout is the inflammation of joints due to accumulation of -

(A) Urea crystal (B) NH3

(C) Uric acid crystal (D) CaCO3 crystals

24. I. Age-related disorder characterised by decreased bone mass and increased chances of fracture

II. Causative factor deficiency of estrogen is common.

The above characters are associated with –

(A) Gout (B) Osteoporosis

(C) Arthritis (D) Polio

25. Myasthenia is an ____ disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscles -

(A)Arthritis (B) Autoimmune

(C) Agnosic (D)Amnesic

26. Tetany is the rapid spasm in muscles due to –

(A) High Ca+2 in body fluid (B) Low Ca+2 in body fluid

(C) High uric acid in body fluid (D) High urea in blood

27. Progressive degeneration of skeletal muscles due to genetic disorder is called -

(A) Myasthenia gravis (B) Tetany

(C) Muscular dystrophy (D) Myopia

THANK YOU !!

MANTHAN NEET 2025

NEURAL CONTROL AND CORDINATION

LECTURE - 1

ZOOLOGY



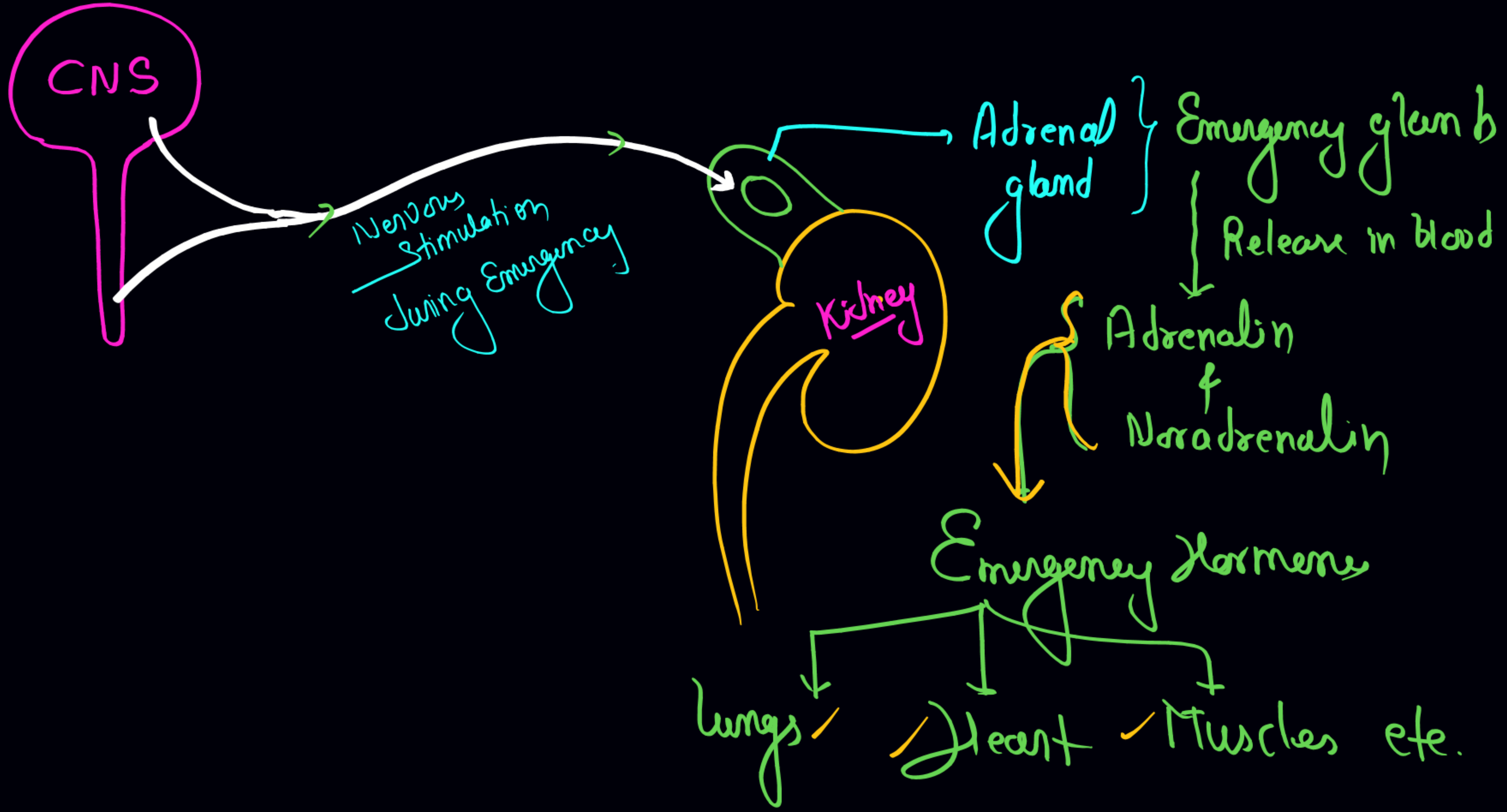
MD SIR

❑ TODAY'S GOAL -

- ❑ Structure of Neuron ✓
- ❑ Types of Neuron

Neural System

- Coordination is the process through which two or more organs interact and complement the functions of one another
- In our body the neural system and the endocrine system jointly coordinate and integrate all the activities of the organs so that they function in a synchronised fashion
- The neural system provides an organised network of point-to-point connections for a quick coordination. The endocrine system provides chemical integration through hormones


CNS
Nervous Stimulation
During Emergency
Adrenal gland
Emergency glands
Release in blood
Kidney
Adrenalin
&
Noradrenalin
Emergency Hormones
Lungs
Heart
Muscles etc.

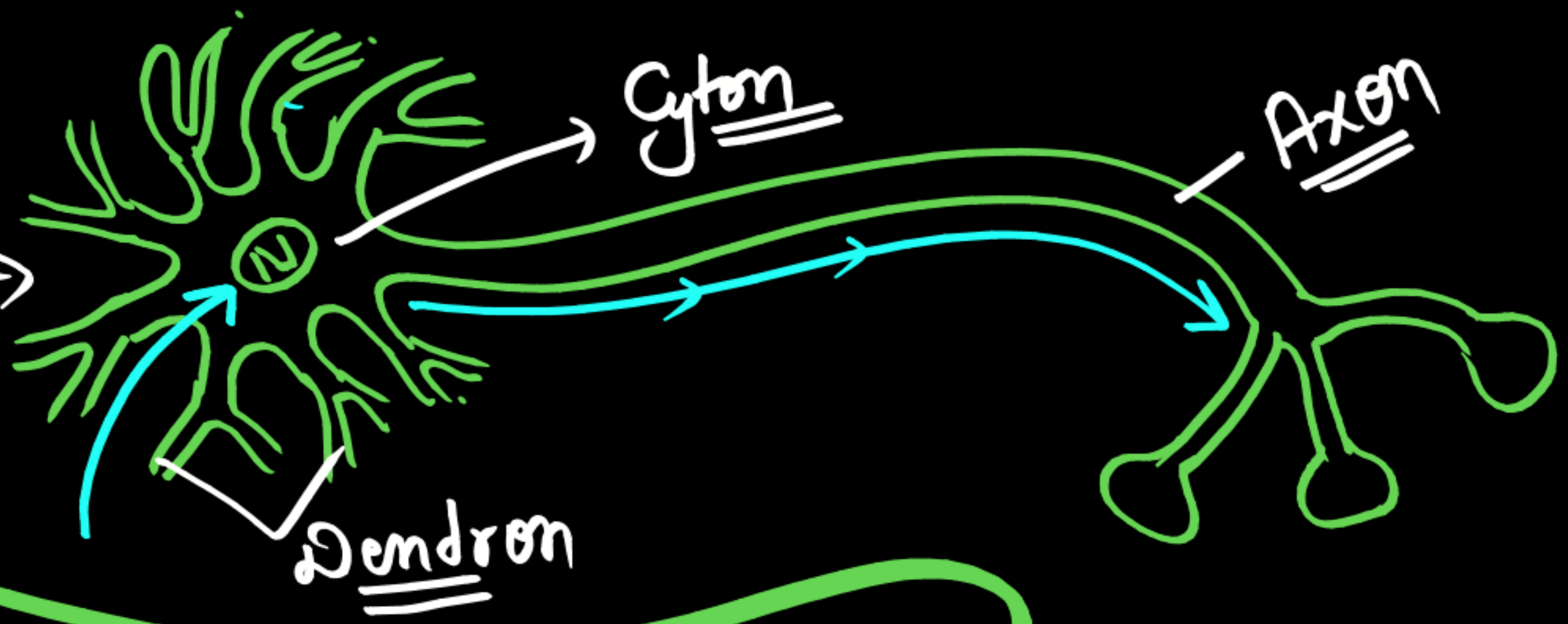
- The neural organisation is very simple in lower invertebrates. For example, in Hydra it is composed of a network of neurons. The neural system is better organised in insects, where a brain is present along with a number of ganglia and neural tissues.

Collection of Cyton

- 1st Nerve Cell Originate in = Hydra.
- 1st Time Cephalisation & Nervous System develop in ⇒ Platyhelminthes
- Origin of Nerve Cell = Ectodermal

NEURON AS STRUCTURAL AND FUNCTIONAL UNIT OF NEURAL SYSTEM

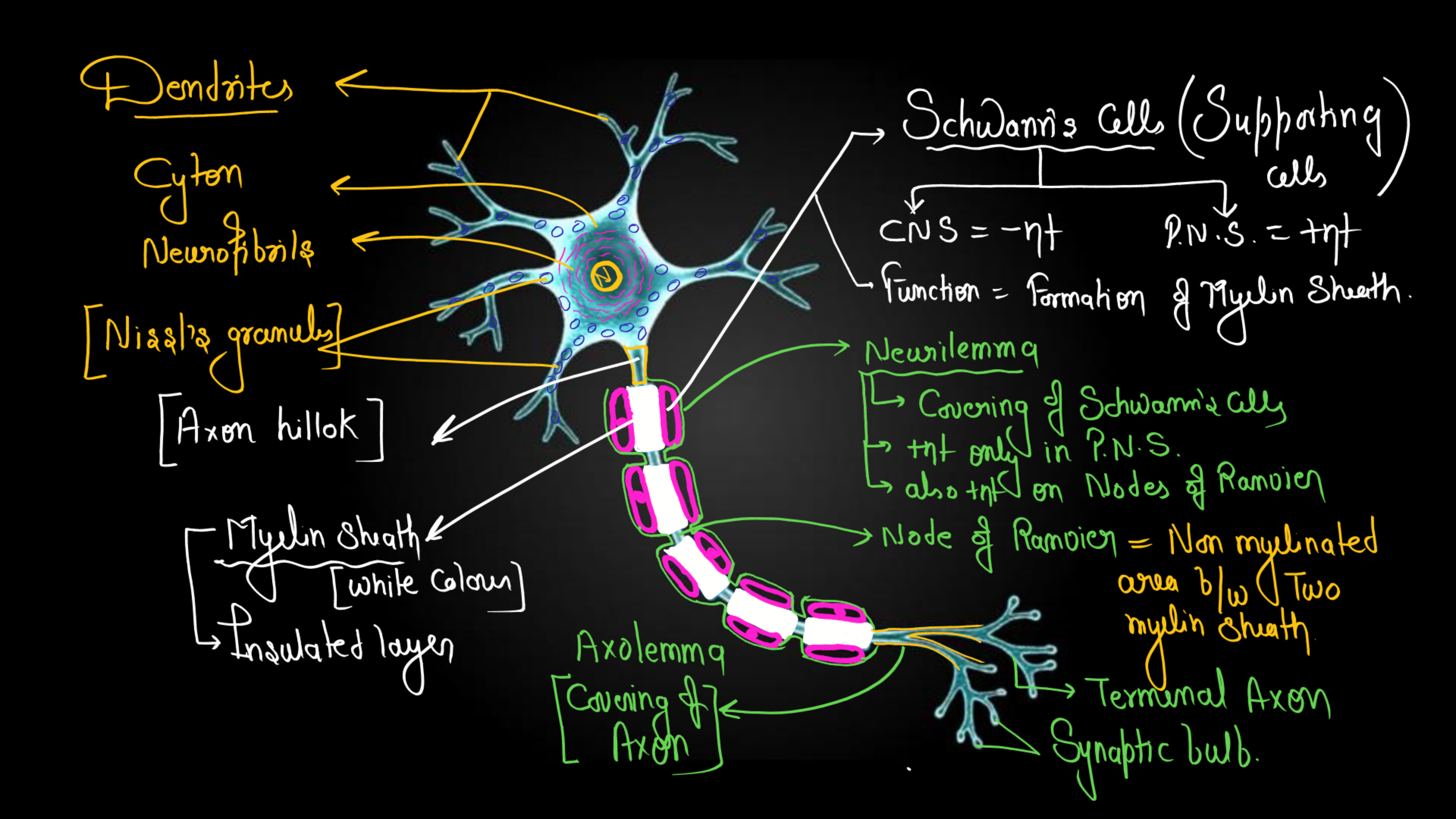
(Structure of Nerve Cell →



Cell / Cyton / Cell body / Perikaryon / Soma.

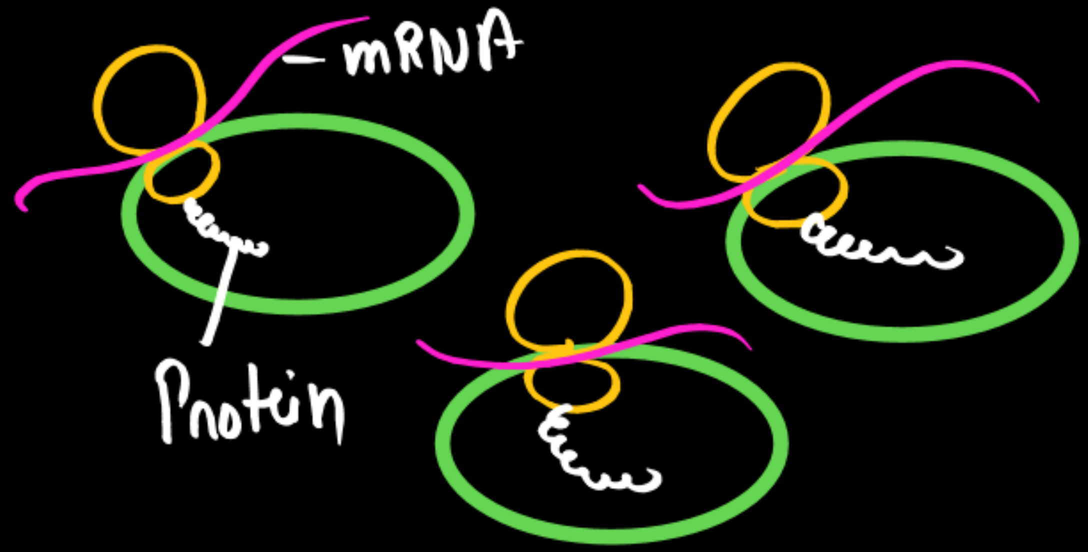
[Process]

- [Branched] → Dendron = Sensory or Afferent
- [Unbranched] → Axon = Motor or Efferent


Dendrites
Cyton
Neurofibrils
[Nissl's granules]
[Axon hillok]
Mylin Sheath
[white Colour]
Insulated layer
Schwann's cells (Supporting cells)
CNS = -nt
P.N.S. = +nt
Function = Formation of Mylin Sheath.
Neurilemma
Covering of Schwann's cells
+nt only in P.N.S.
also +nt on Nodes of Ranvier
Node of Ranvier = Non mylinated area b/w Two mylin sheath
Axolemma
[Covering of Axon]
Terminal Axon
Synaptic bulb.

Nissl's Granules → (Grey Colour)

- → Site of Protein Synthesis
- → Nissl's granules = Ribosomes + Endoplasmic Reticulum
- +nt = Dendron + Cyton
- -nt = Axon hillok + Axon



Myelin Sheath (Insulated layer of lipid)

lipid → (Sphingolipid)

[C.N.S.]

* Mostly Neurons are Myelinated
• Some also Nonmyelinated

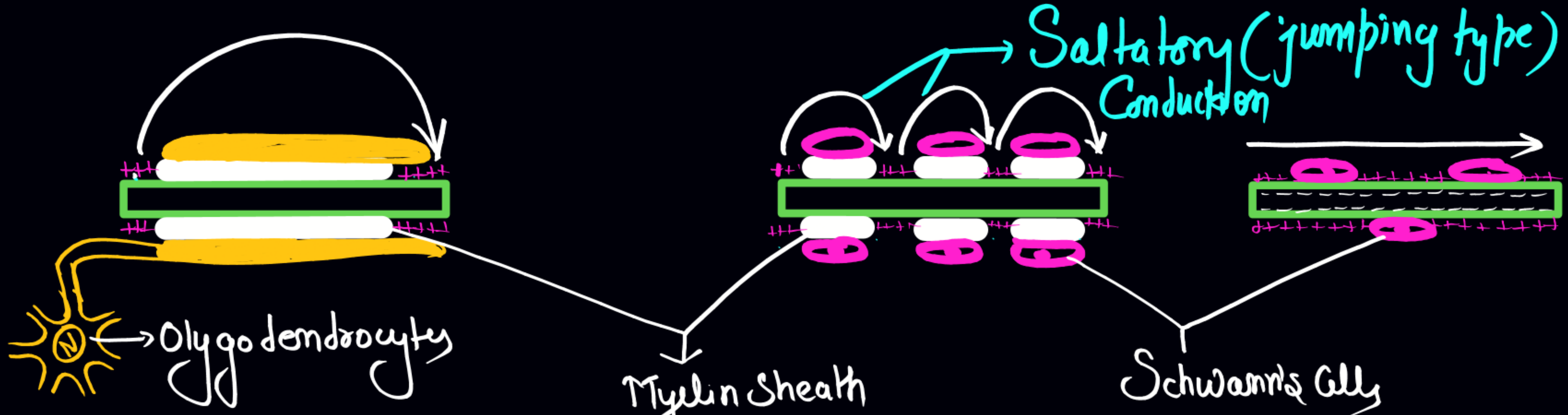
* Myelin Sheath form by => [Olygodendrocytes]

[P.N.S.]

[Myelinated] + [Nonmyelinated]

• Formed by => [Schwann's Cells]

• In nonmyelinated Neuron
  → Schwann's Cells +nt
  → Nodes of Ranvier −nt



* Mylin -nt
* Schwann's +nt
* Nodes of Ran. -nt

* Continuous mylin sheath With few nodes of Ramuier

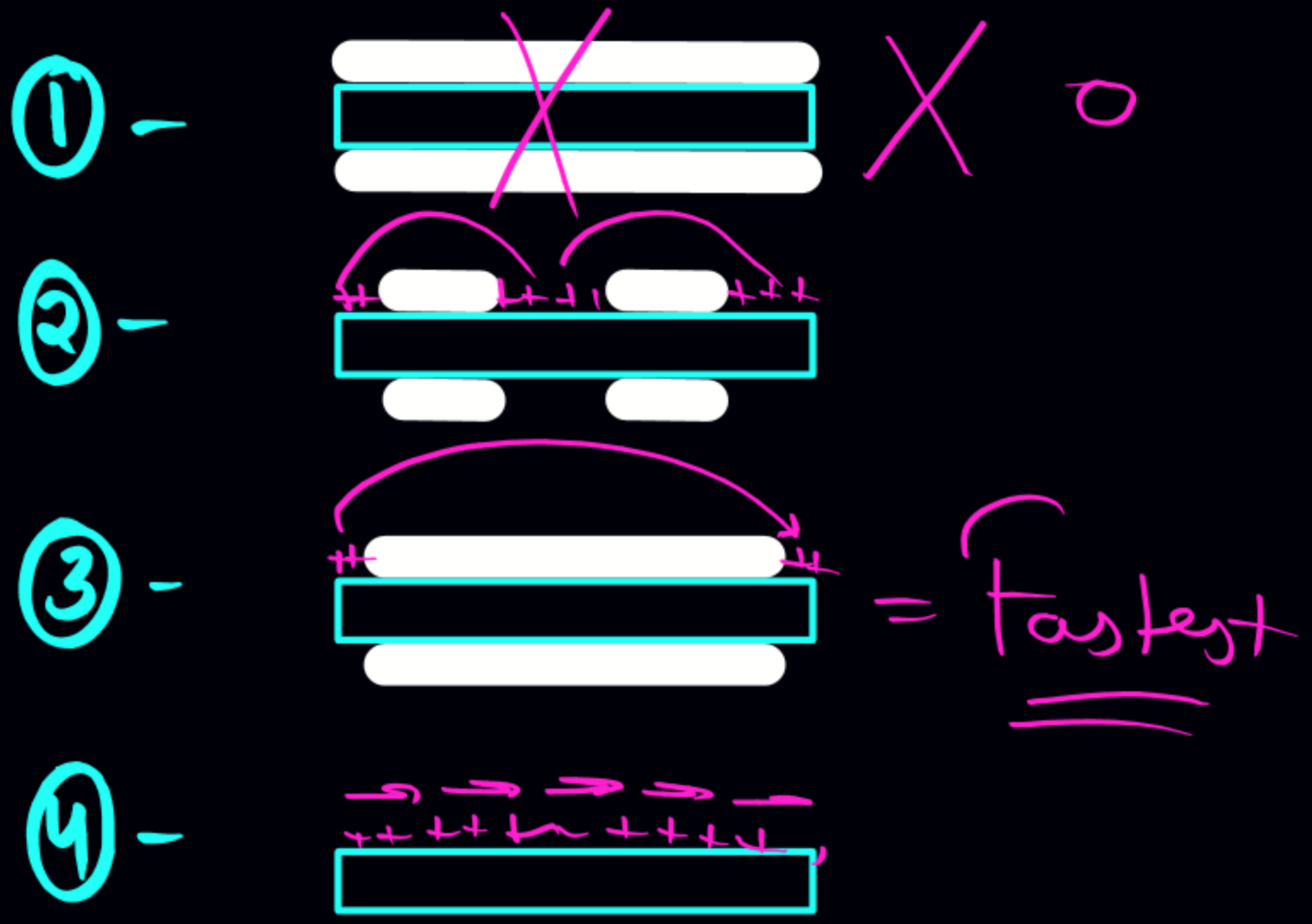
* Discontinuous Mylin Sheath With many Nondes of Ramuier

✓ Speed of Conduction = Fastest

· Fast

Slow.

Q-1 = Conduction Speed Fastest = ?



H.W

1.Coordination is considered as an important process in an animal body because
A) it helps to maintain homeostasis.
B) it enables different organs to interact and function efficiently.
C) it ensures the normal functioning of vital organs.
D) all of these

2. The neural system within human body provide
A) chemical coordination through hormones
B) point to point connections
C) electrical coordination
D) both (b) and (c)

3. Neurons are the specialised cells of nervous system in
A) humans only
B) all vertebrates only
C) mostly all animals including vertebrates and invertebrates
D) both (A) and (B)

4 . The neurons in all animals are capable of
i. detecting various stimuli in environment
ii. receiving and transmitting stimuli to CNS
iii. processing various internal and external stimuli
Select the most appropriate option.
A) I, II and III are correct
B) Only II is correct
C) II and III are correct
D) I and II are correct

5. The nervous system of Hydra is composed of
A) brain and peripheral nerves
B) network of neurons
C) ganglia and plexuses
D) brain and nerve nets

6. Why is nervous system of insects considered better organised as compared to Hydra and Planaria?
A) Insects possess brain, ganglia and neural tissues.
B) Hydra and planaria do not possess nervous system at all.
C) Hydra possess the least developed nerve cord while insects contain highly developed ventral nerve cord.
D) Planaria do not possess brain while a rudimentary brain is found in insects

THANK YOU !!

MANTHAN NEET 2025

NEURAL CONTROL AND CORDINATION

LECTURE - 2

ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

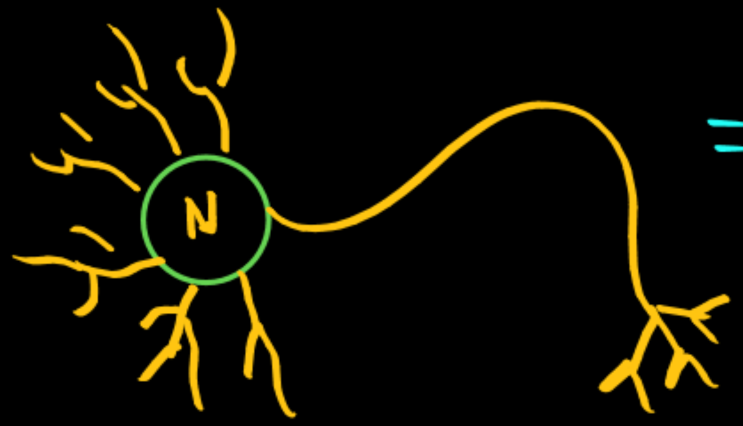
- ❑ Types of Neurons
- ❑ Human Neural System
- ❑ Conduction of Nerve Impulse
- ❑ Human brain

Types of Neuron

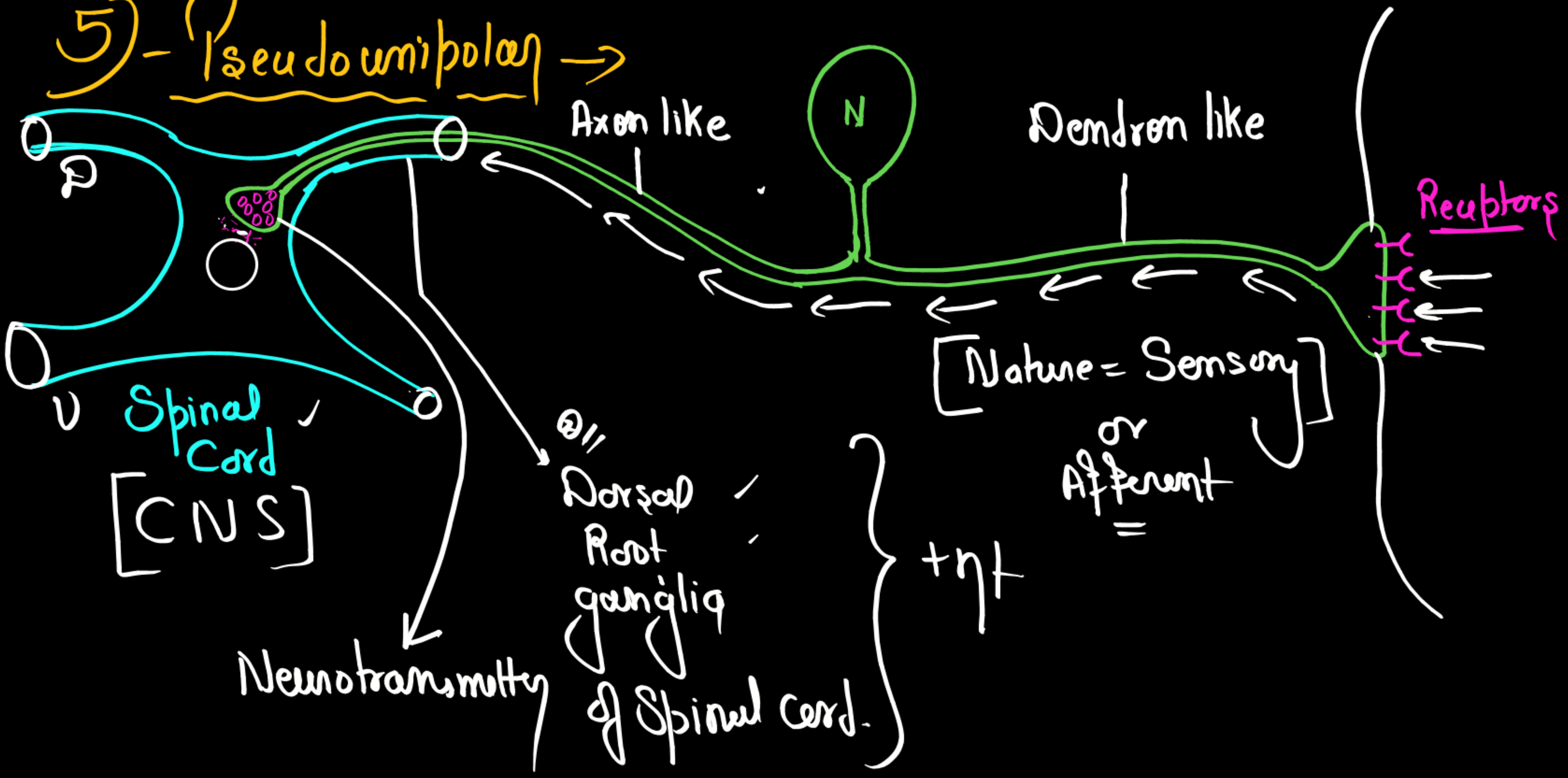
1) → Apolar  = Dendron + Axon } -nt eg → Hydra

2) → Unipolar  = Axon +nt eg = Early Embryo

3) - Bipolar  = [Single Dendron, Single Axon] eg - Eyes + Nose, Ear etc.

4) - Multipolar  = → Many dendron, → Single Axon eg - Mostly +nt in body

5)- Pseudounipolar →



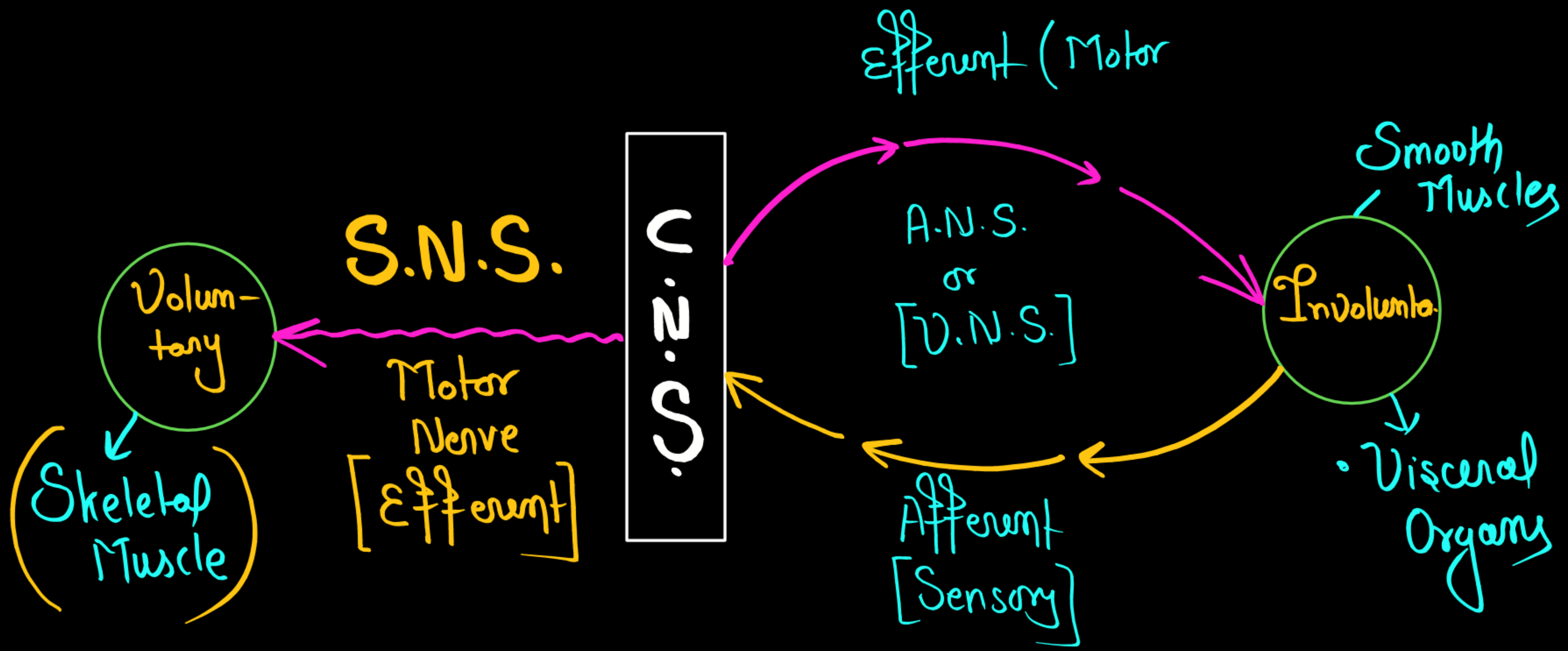
Human Neural System

1) - Central Nervous System (CNS) = Brain + Spinal Cord

2) - Peripheral Nervous System (P.N.S.) = Cranial Nerve + Spinal Nerve

- Peripheral Nervous System → {Network of Nerve which Connect CNS to body Organ}
- Cranial Nerve [12-Pairs] → (Sensory + Motor + Mixed)
- Spinal Nerve [31-Pairs] → (Mixed)

P.N.S.
- A.N.S [Involuntary]
  - Normal = Parasympathatic
  - Emergency = Sympathatic
- S.N.S [Voluntary]



Efferent (Motor
Smooth Muscles
S.N.S.
C.N.S
A.N.S.
or
[V.N.S.]
Volun-tary
Involunta.
Motor Nerve [Efferent]
Skeletal Muscle
Afferent [Sensory]
• Visceral Organs

Major part of peripheral nervous system is somatic neural system which relays impulses from

(1) CNS to skin

(2) CNS to smooth muscles

(3) CNS to involuntary muscle

(4) CNS to skeletal muscle

21.2 Human Neural System

The human neural system is divided into two parts :

(i) the **central neural system** (CNS)

(ii) the **peripheral neural system** (PNS)

The CNS includes the **brain** and the **spinal cord** and is the site of information processing and control. The PNS comprises of all the nerves of the body associated with the CNS (brain and spinal cord). The nerve fibres of the PNS are of two types :

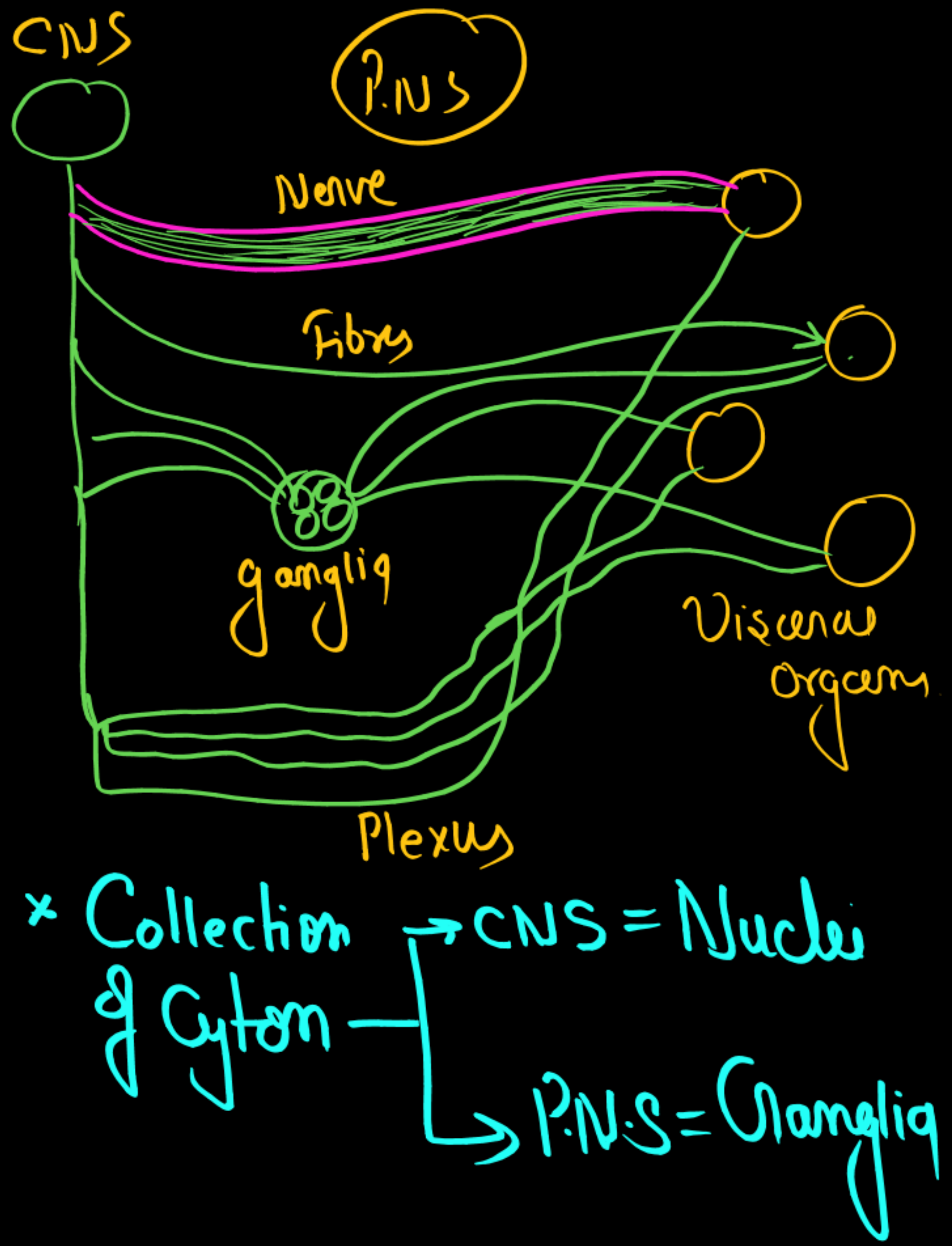
(a) **afferent fibres** → Sensory

(b) **efferent fibres** → Motor

The afferent nerve fibres transmit impulses from tissues/organs to the CNS and the efferent fibres transmit regulatory impulses from the CNS to the concerned peripheral tissues/organs.

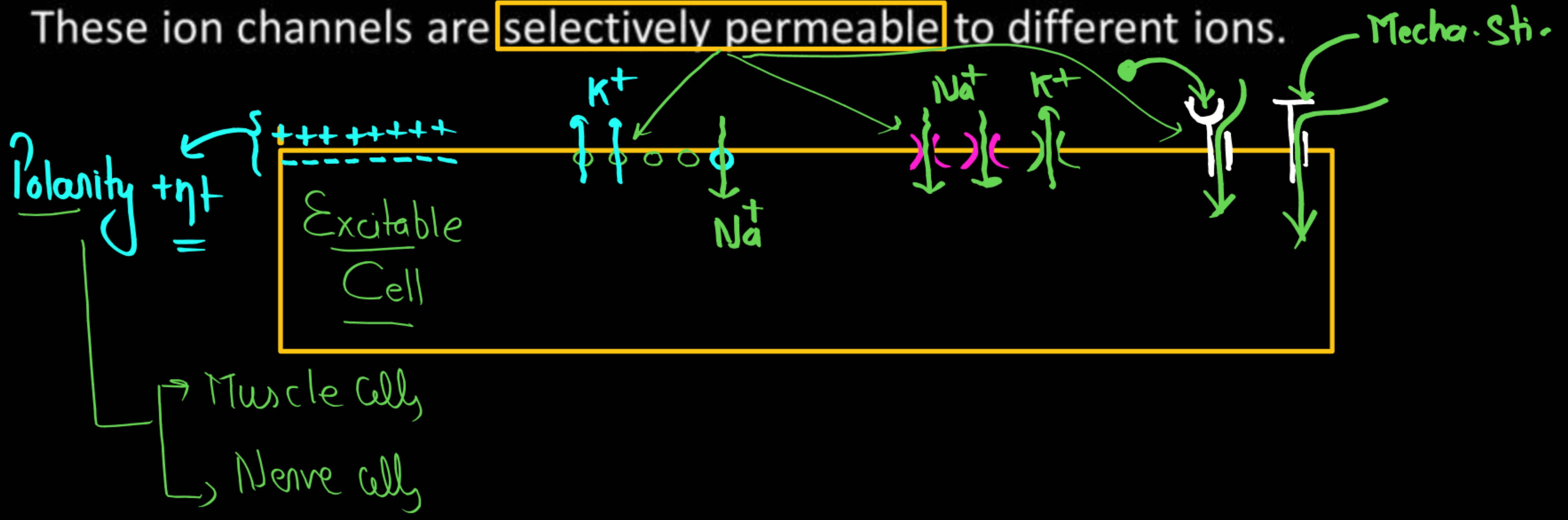
The PNS is divided into two divisions called **somatic neural system** and **autonomic neural system**. The somatic neural system relays impulses from the CNS to skeletal muscles while the autonomic neural system transmits impulses from the CNS to the involuntary organs and smooth muscles of the body. The autonomic neural system is further classified into **sympathetic neural system** and **parasympathetic neural system**.

Visceral nervous system is the part of the peripheral nervous system that comprises the whole complex of nerves, fibres, ganglia, and plexuses by which impulses travel from the central nervous system to the viscera and from the viscera to the central nervous system.



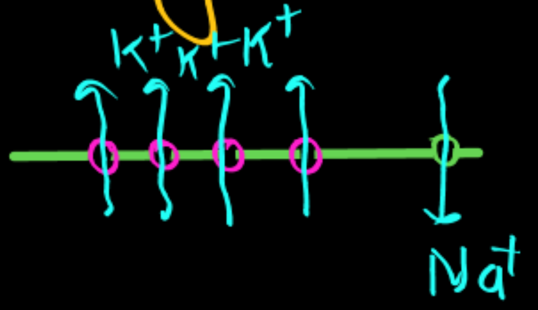
Generation and conduction of Nerve Impulse

- Neurons are excitable cells because their membranes are in a polarized state.
- Different types of ion channels are present on the neural membrane. These ion channels are selectively permeable to different ions.



Types of ions Channels —

Leakage channels



- Always open

eg – K >>> Na → Almost (nil)

Voltage gated channels

↓ Opening of cha. depend upon Potential of Membrane

eg – Na, K, Ca

Ligand gated Channels

↓ Opening depend upon = Binding of Ligand (Neurotransmitter)

eg – Na, Cl

Mechanical gated channels

↓ Opening depend upon Mechanical Stimulus

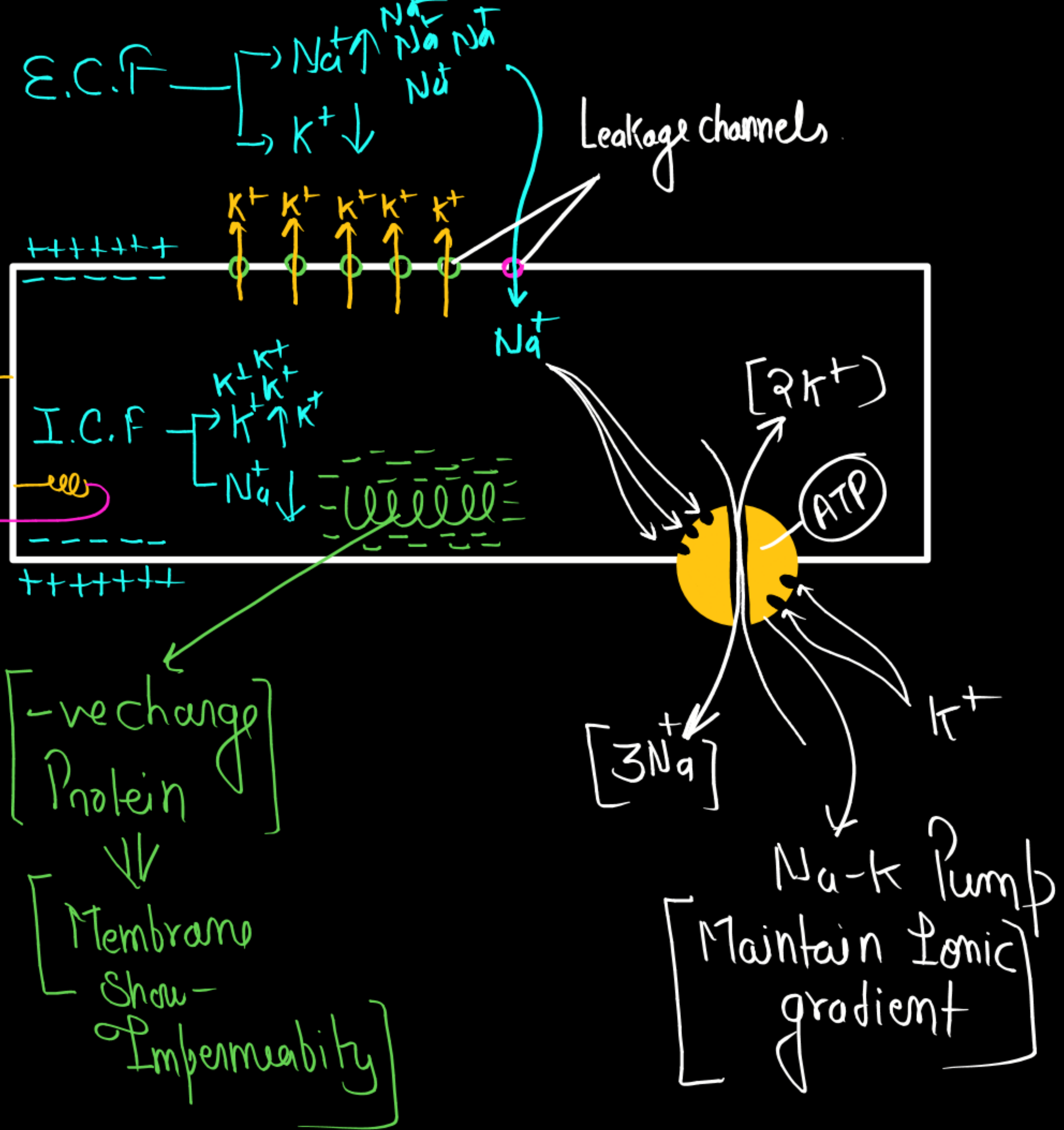
↓ eg Na

Conduction of Impulse →

1) → Resting Phase or Polarisation State →

* Resting Mem. Potential = −70 mV

* Permeability → K^+ ↑↑, Na ↓



Ans.....Last BMS-QMD

1	2	3	4	5	6
D	D	C	D	B	A

H.W.

1. The two major divisions of human neural system are

A) CNS and brain
B) ANS and PNS
C) CNS and PNS
D)Brain and spinal cord

2. Consider the following statements.

(A) Central nervous system is the major site of information processing.

(B) Central nervous system is composed of brain and cranial nerves.

Select the correct option.

A) A is true, B is false.
B) A is false, B is true.
C) Both A and B are true.
D) Both A and B are false.

3. The major structural component of peripheral nervous system is

A) spinal cord
B) nerves
C) visceral organs
D) all of these

4. The nerve fibres of PNS are

A) Afferent
B) efferent
C) both afferent and efferent
D) only motor

5. Consider the following statements.

I. Two major division of CNS are somatic neural system and autonomic neural system.

II. Both somatic and autonomic neural system are antagonistic in their functions.

Select the correct option.

A) I is true, II is false.
B) Both I and II are true.
C) I is false, II is true.
D) Both I and II are false.

6. Select the correct statement.

A) Somatic neural system consists of both afferent and efferent nerves.
B) Autonomic neural system consists of only afferent fibres.
C) Only efferent nerves are found in somatic and autonomic neural system.
D) Both afferent and efferent fibres are found in somatic and autonomic neural system.

7. The two divisions of autonomic nervous system are

A) antagonistic to each other
B) complementary to each other
C) highly reduced and non-functional in humans
D) functional as a single system in humans

8. The basic structural components of a neuron are
A) cell body and axon
B) cell body and dendrites
C) axon and dendrites
D) cell body, axon and dendrites

9. Identify the incorrectly matched pair of cell organelle found in neuron and its function.
A) Nucleus – Contain DNA
B) Mitochondria – Energy production
C) Golgi apparatus – Protein synthesis
D) Lysosomes – Scavengers of neurons

10. Neurons differ from a typical cell because of the presence of
A) nucleolus
B) Nissl's granules
C) protein synthesizing machinery
D) Microfilaments

11. Nissl bodies are mainly composed of
A) proteins and lipids
B) DNA and RNA
C) nucleic acids and SER
D) free ribosomes and RER

Why the membrane of a neuron is polarised?
Mark the wrong statement

1. The outer surface of the axonal membrane possesses a positive charge while its inner surface is negatively charged
2. The axoplasm inside the axon contains high concentration of K+ and negatively charged proteins and low concentration of Na+
3. The fluid outside the axon contains a low concentration of K+, and high concentration of Na+, forming a concentration gradient
4. A resting membrane is comparatively more permeable to Na+ and nearly impermeable to K+

If the Na+— K+ pump is blocked then

1. Na+ and K+ will be excess in extracellular fluid
2. Excess amount of Na+ in extracellular fluid
3. Excess amount of K+ in intracellular fluid
4. Excess amount of Na+ in intracellular fluid

THANK YOU !!

MANTHAN NEET 2025

NEURAL CONTROL AND CORDINATION

LECTURE - 3

ZOOLOGY



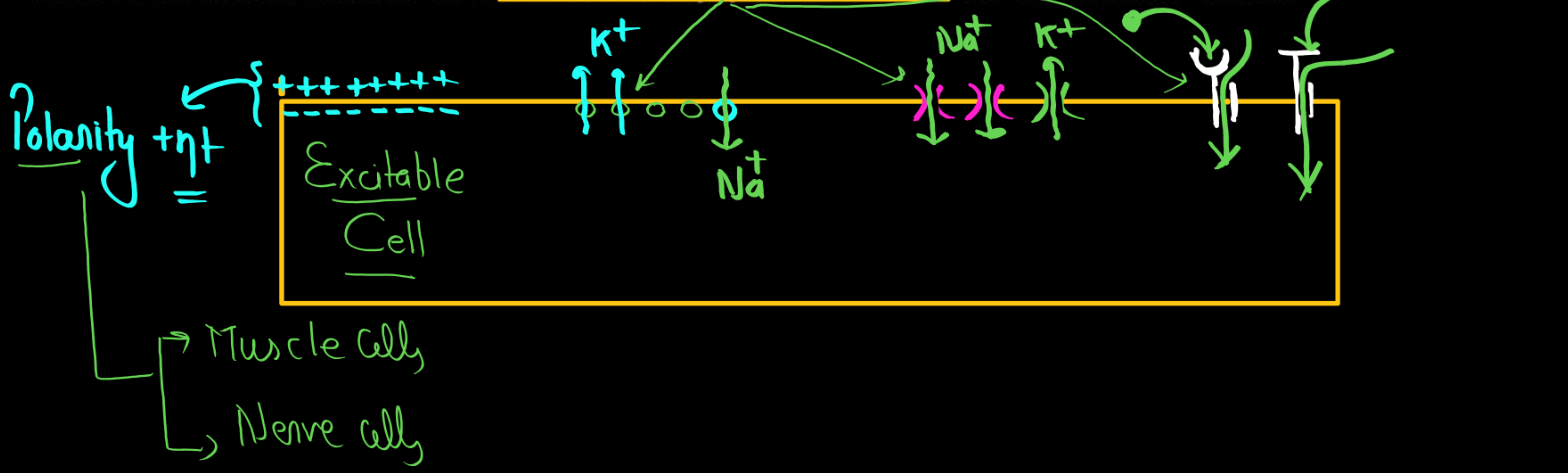
MD SIR

❑ TODAY'S GOAL -

- ❑ Conduction of Nerve Impulse
- ❑ Types of synapses

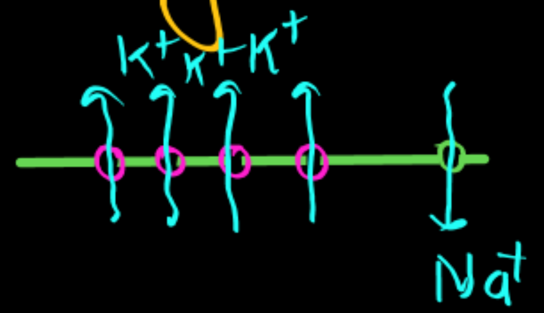
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Types of ions Channels —

{Leakage channels}



- Always open

eg - K >>> Na → Almost nil

[Voltage gated channels]

↓

Opening of cha. depend upon Potential of Membrane

eg - Na, K, Ca.

Ligand gated Channels

↓

Opening depend upon = Binding of Ligand (Neurotransmitter)

eg - Na, Cl

[Mechanical gated channels]

↓

Opening depend upon Mechanical Stimulus

↓

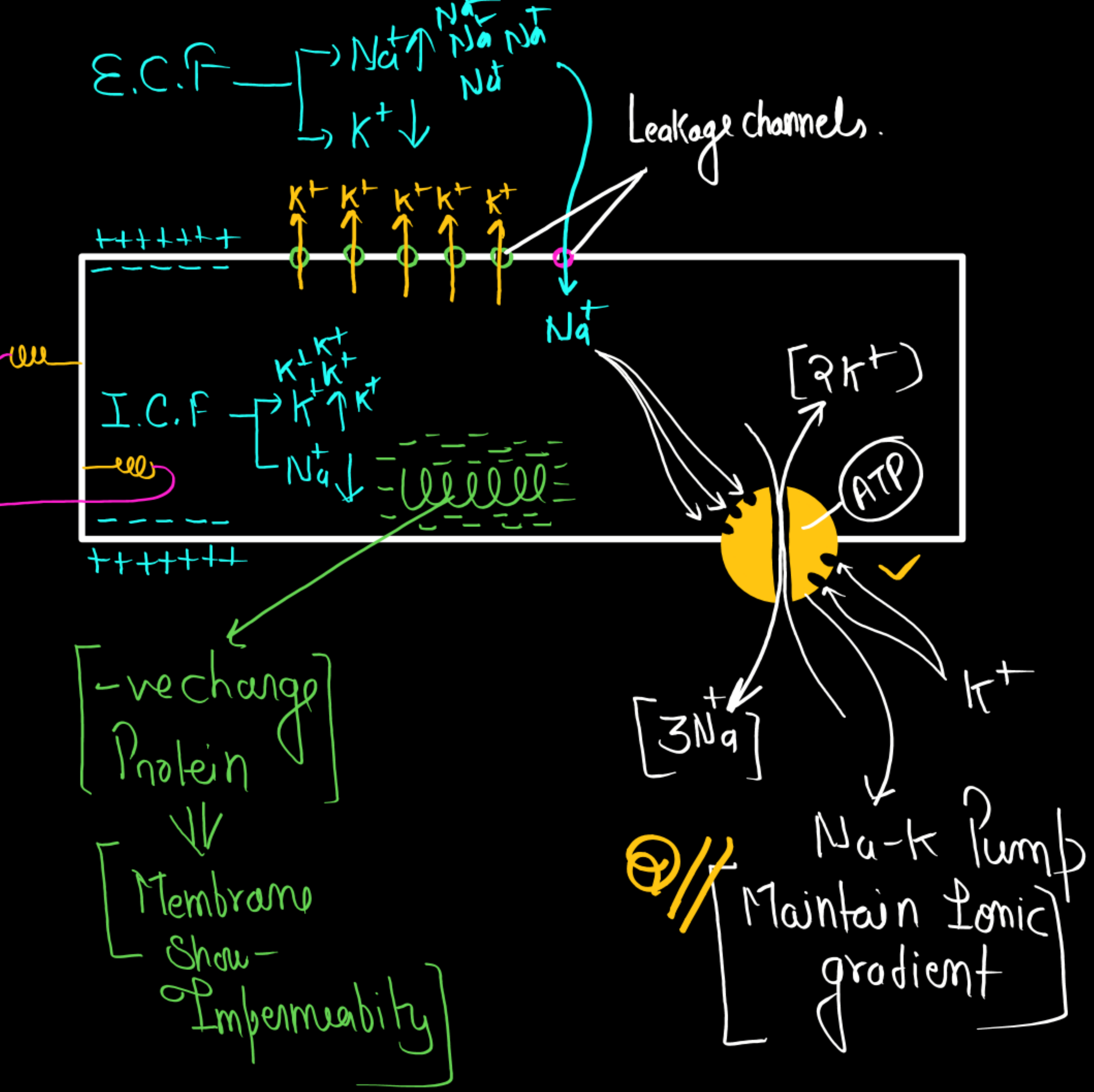
eg Na

Conduction of Impulse →

1) → Resting Phase → or Polarisation State

* Resting Mem. Potential = −70 mV

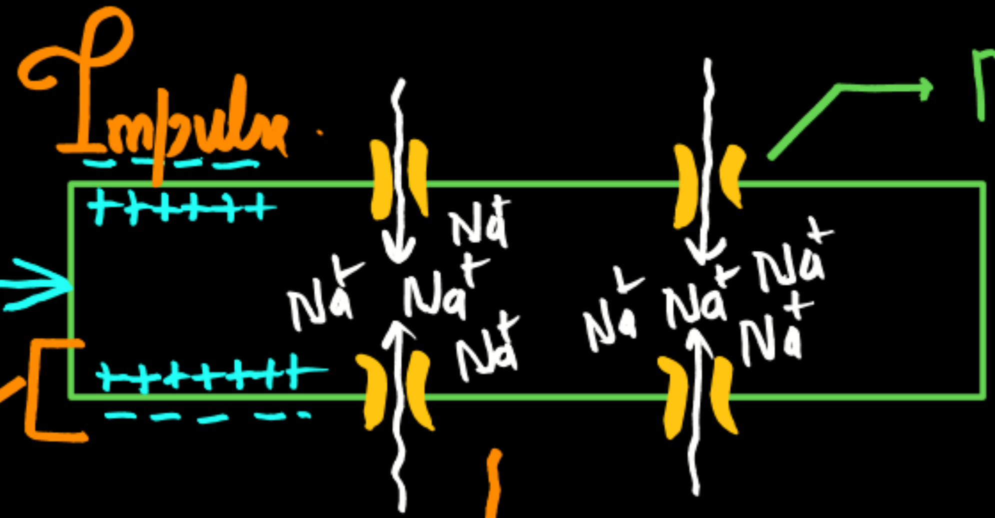
* Permeability → K^+ ↑↑
  → Na ↓



2) - Depolarisation →

or

Active - Phase → Stimulate →

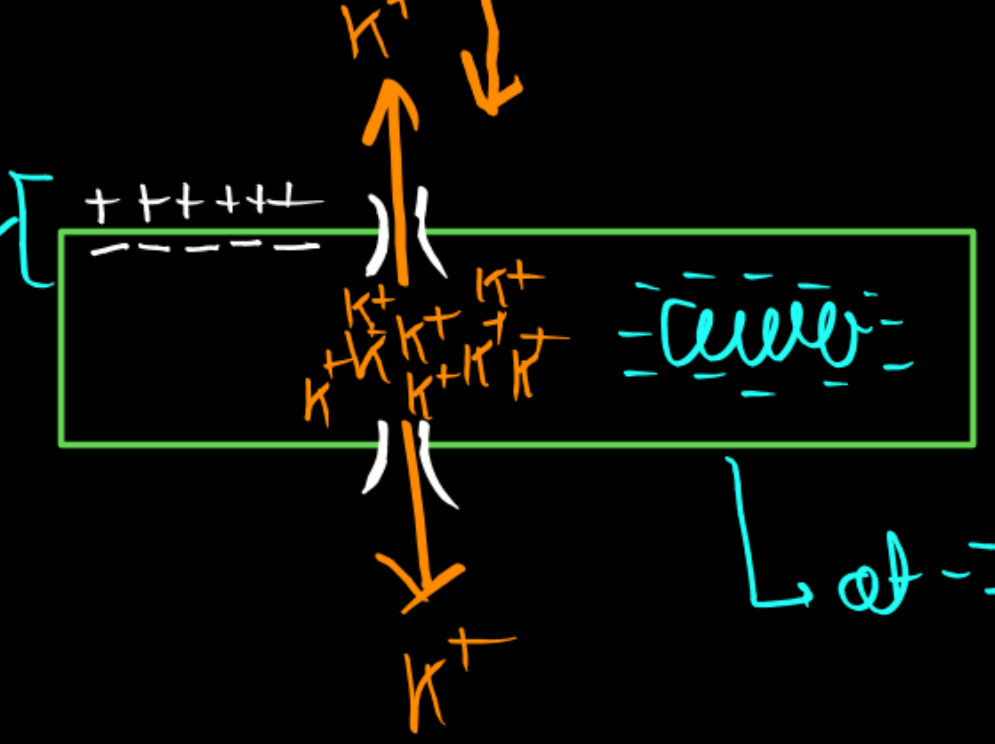


Na - VGC = Open

* Action Potential = +30 mV
* Permeability = [→ Na^+ = ↑ ; → K^+ = ↓]

⇒ at +30 mV —
- → Inactivation of Na - VGC
- → K - VGC = open

3) - Repolarisation →



* Potential = −70 mV
* Permeability = [K^+ = ↑ ; Na^+ = ↓]

└ at −70 mV = K VGC → Closed.

4)- Hyperpolarisation →

↓

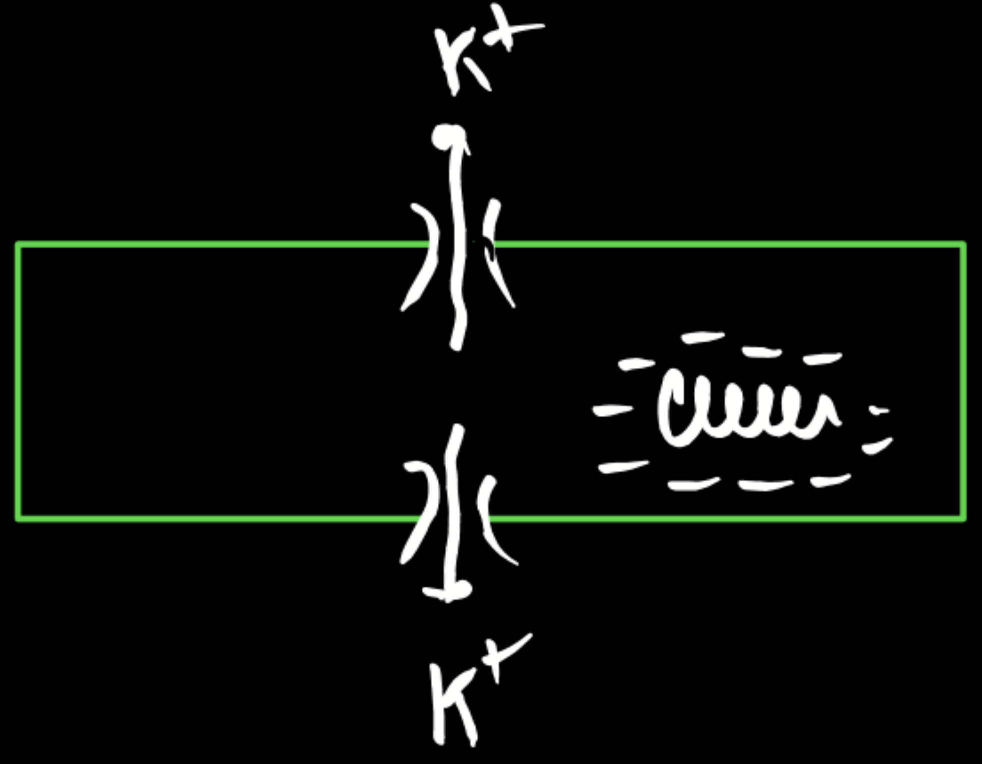
Due to late closing of K- VGC

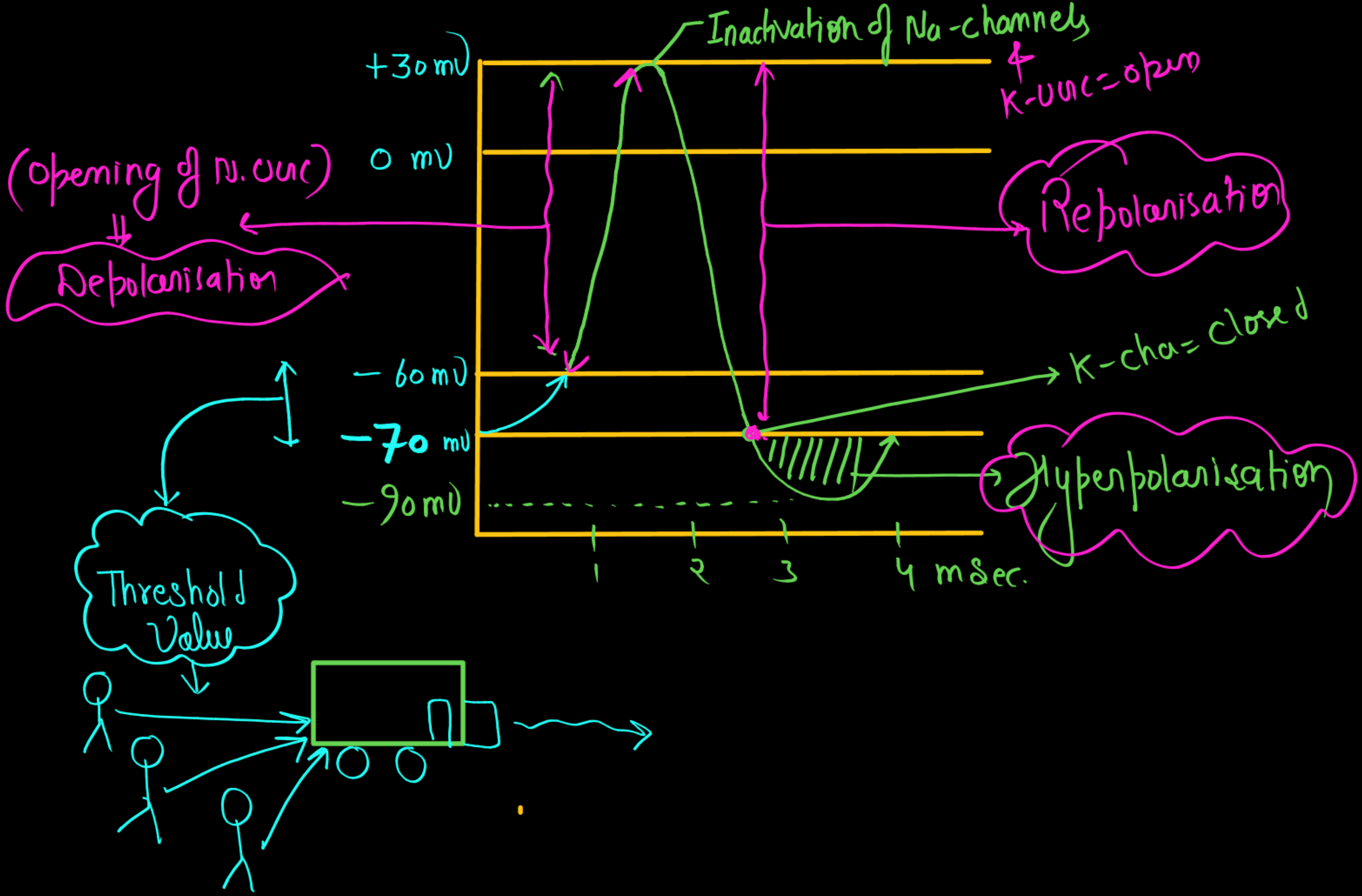
- Potential > −70 mV

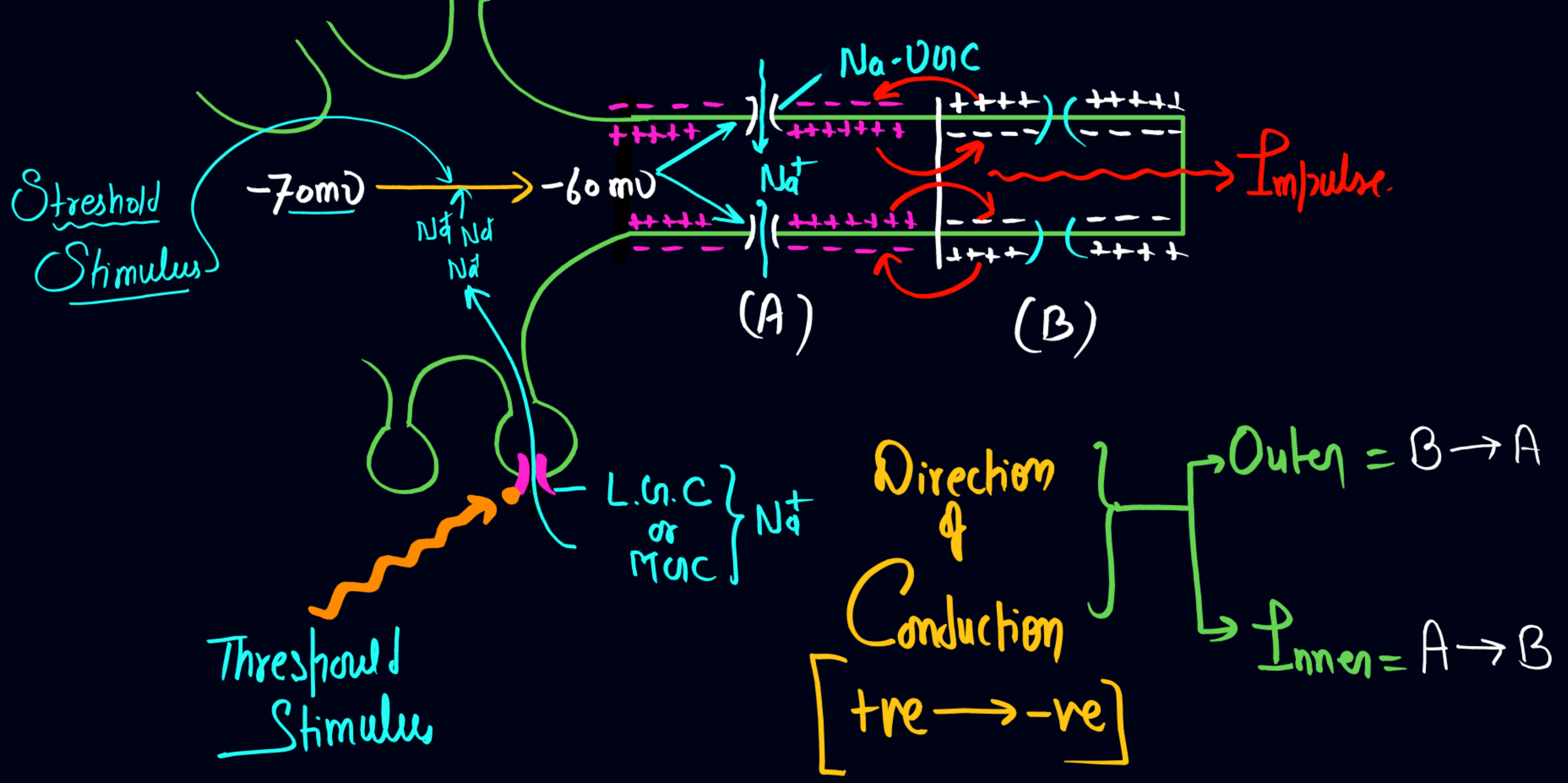
⇓

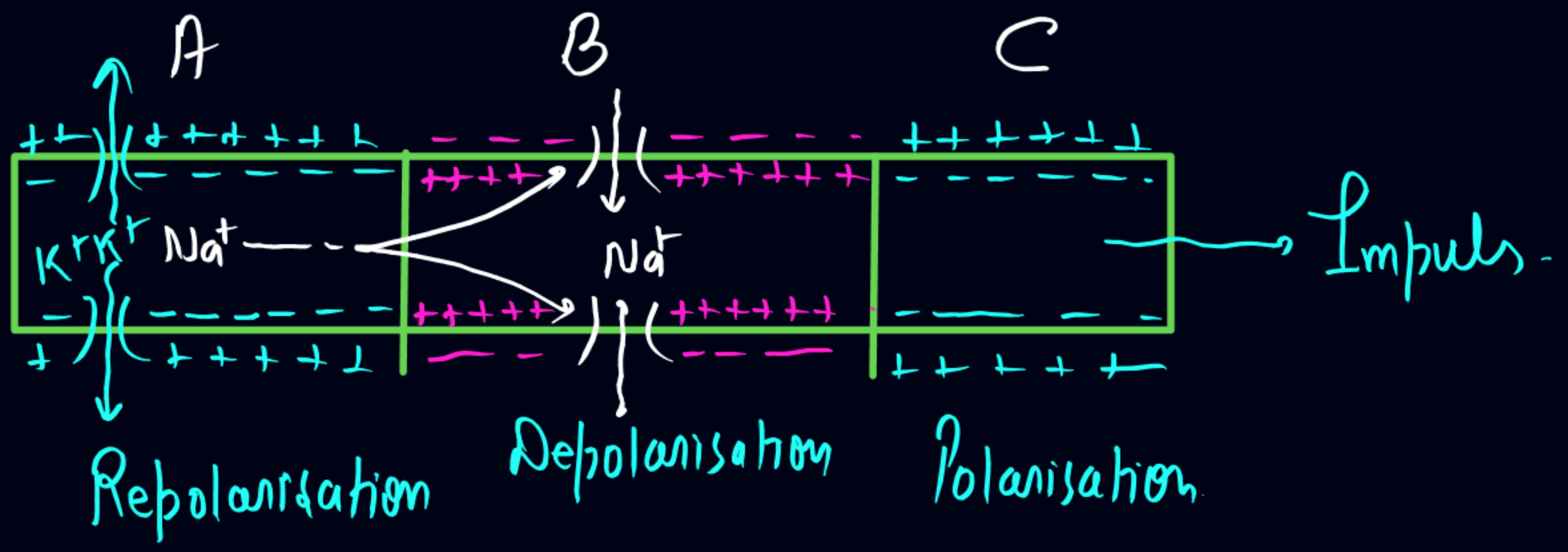
[−90 mV]

- Permeability — [$K^+ = \uparrow$, $Na^+ = \downarrow$]




Inactivation of Na-channels
&
K-vhc = open
+30 mV
0 mV
(Opening of N. vhc)
Depolarisation
Repolarisation
-60 mV
-70 mV
-90 mV
K-cha = closed
Hyperpolarisation
1
2
3
4 msec.
Threshold Value


Na-VGC
Streshold Stimulus
-70mV → -60mV
Na+ Na+ Na+
Na+
Impulse
(A)
(B)
L.G.C or MGC } Na+
Threshould Stimulus
Direction of Conduction
[+ve → -ve]
Outer = B → A
Inner = A → B



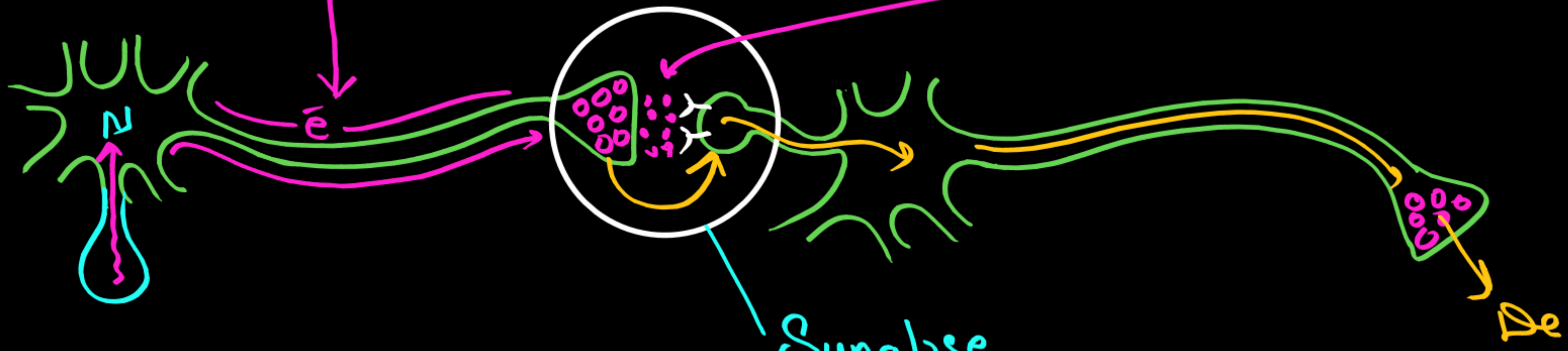
A
B
C
K^+
Na^+
Na^+
Impuls
Repolarisation
Depolarisation
Polarisation

Types of Synapse

Conduction of Nerve Impulse = Electro-Chemical Process

Electro → With in Neuron

Chemical → b/w Neuron



Synapse

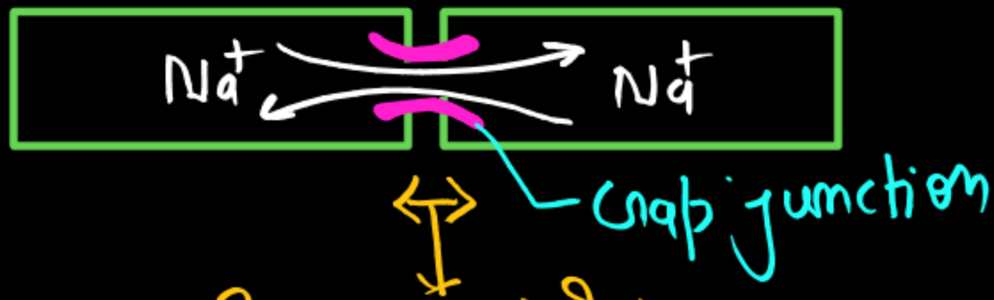
Conduction = unidirectional → Dendron → Cyton → Axon → Dendro

Axon → Neurotrans.

Dendro → Receptor

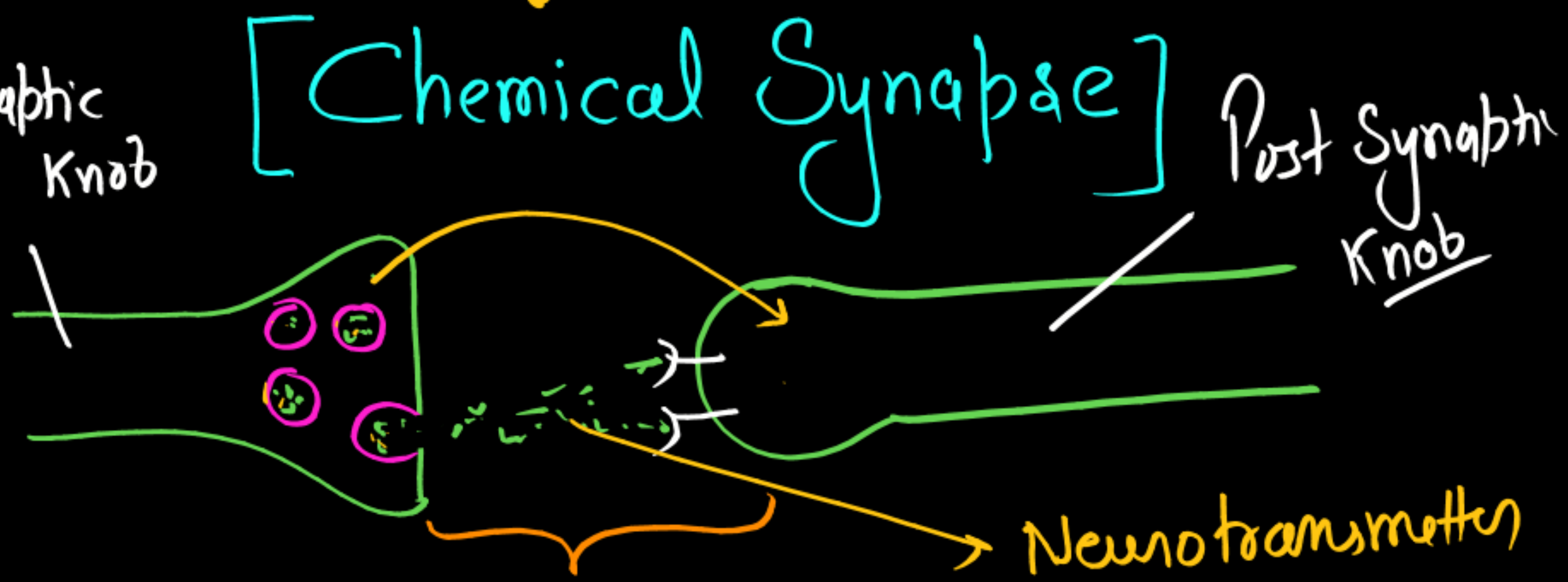
Types of Synapse

[Electrical Synapse] ✗



- Synaptic cleft = 0.2 nm
- Conduction of Impulse = Bidirectional
- Neurotransmitter = –nt
- Synaptic Delay & Fatigue = –nt
- +nt in Cardiac Muscles

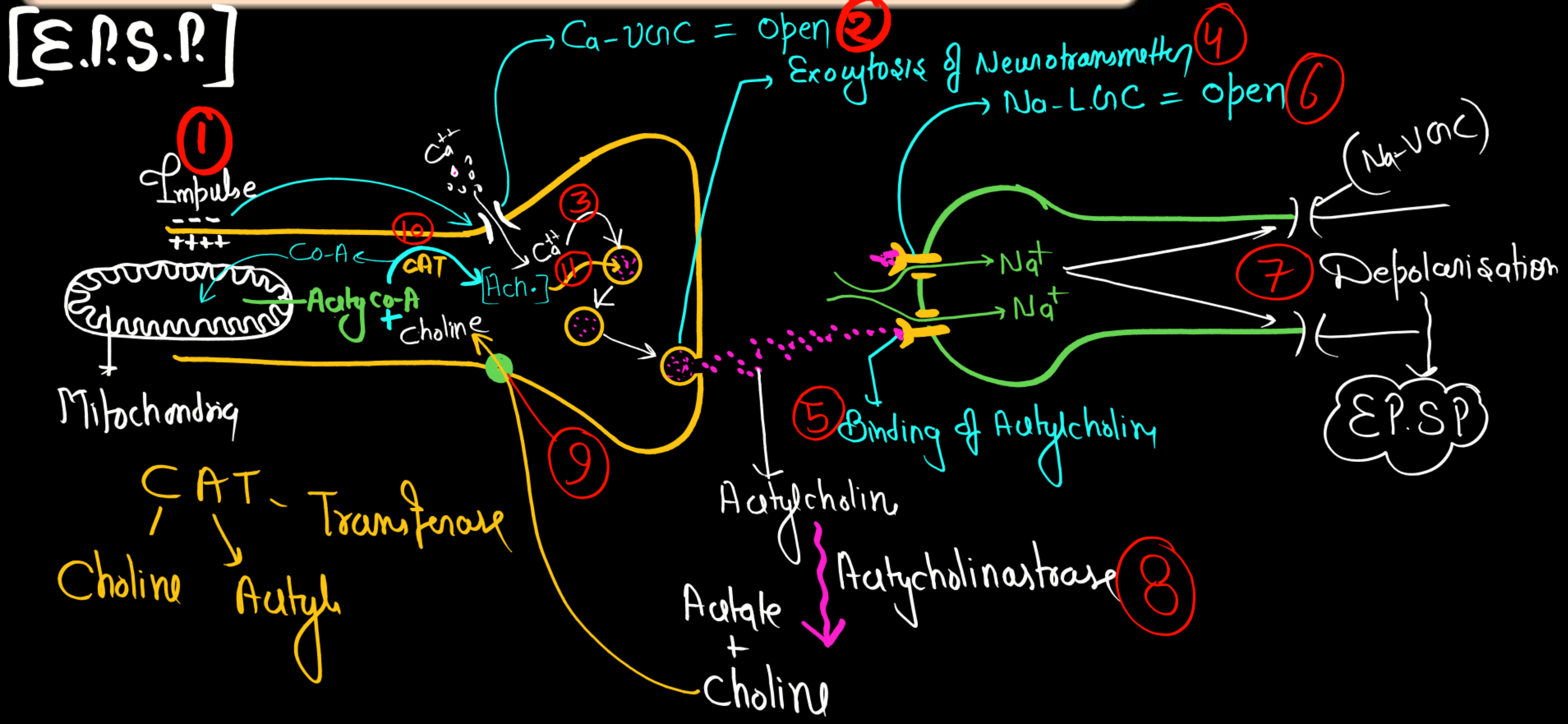
[Chemical Synapse] ✓



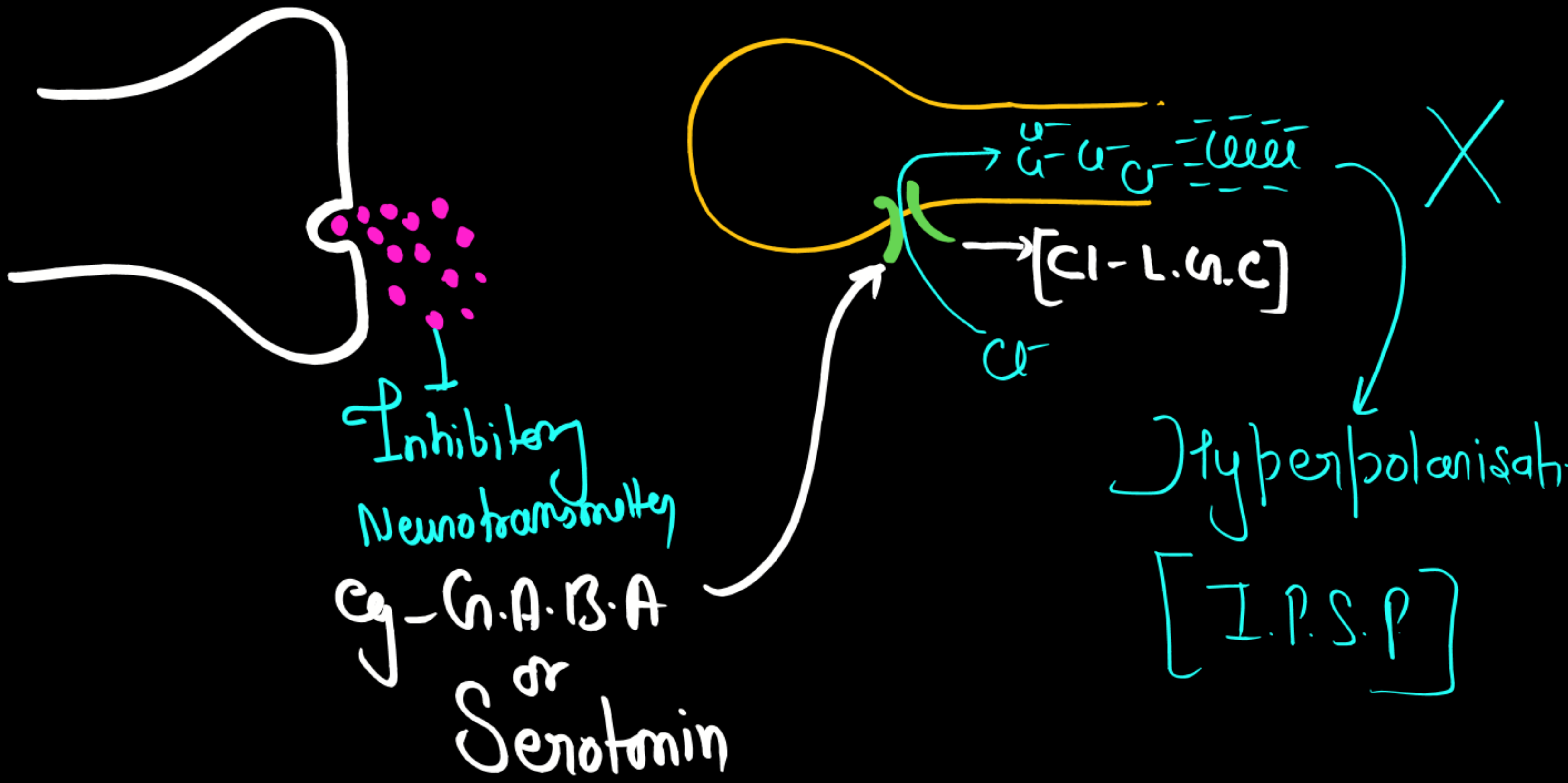
- Synaptic cleft = 20–50 nm
- unidirectional
- +nt
- +nt

eg → Mostly +nt b/w Neurons

TRANSMISSION OF IMPULSE - (Chemical Process)



I.P.S.P.



Inhibitory
Neurotransmitter
eg - G.A.B.A
or
Serotonin
[Cl - L.G.C]
Cl⁻
Hyperpolarisati
[I.P.S.P]

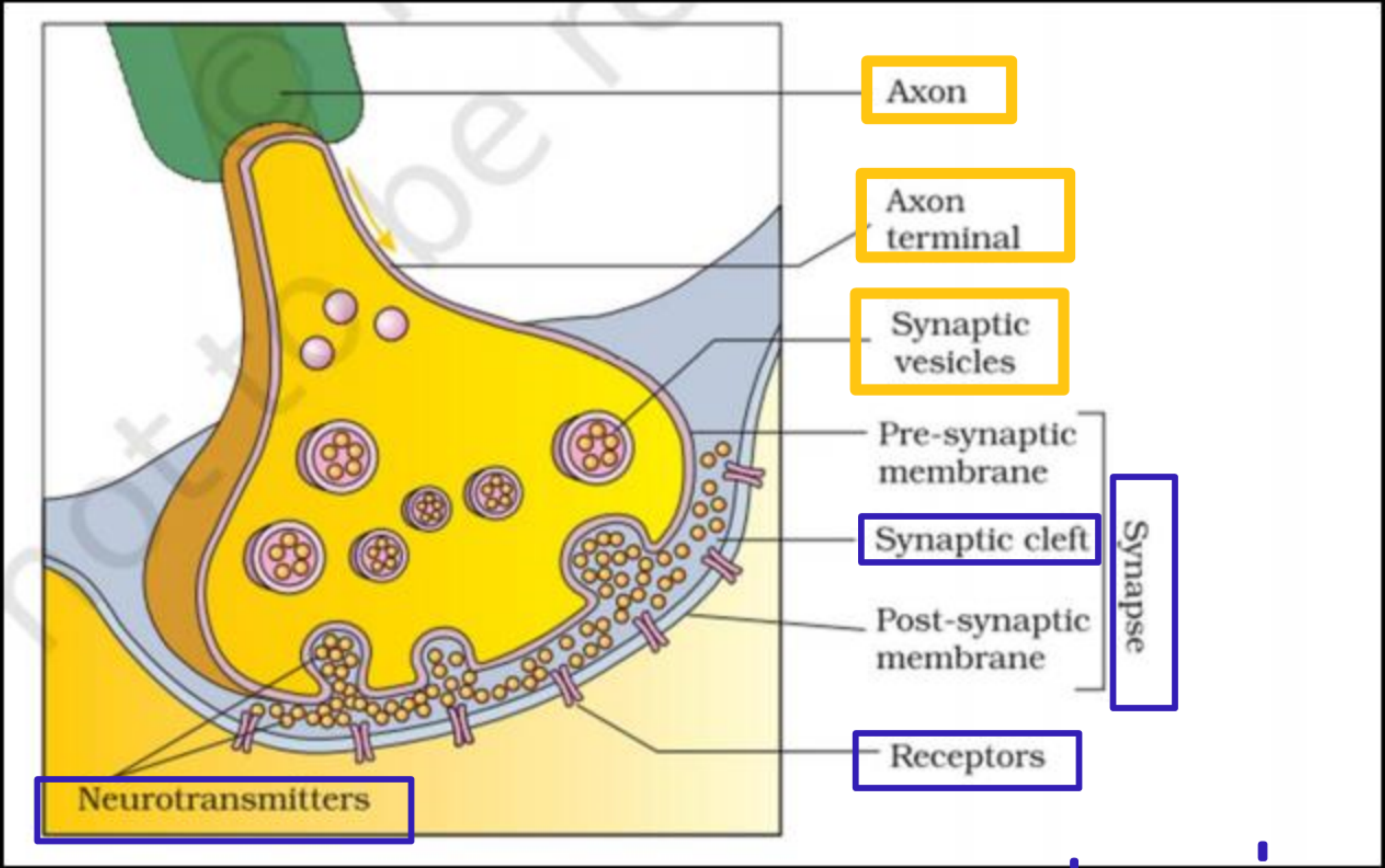
Types of Neurotransmetter

Excitatory [EPSP] = Na^+

- Acetylcholin
- Glutamate
- Aspartate
- Epinephrin
- Norepinephrin

Inhibitory [I.P.S.P.] = Cl^-

- G.A.B.A
- Serotonin
- Glycin
- Dopamine


Axon
Axon terminal
Synaptic vesicles
Pre-synaptic membrane
Synaptic cleft
Post-synaptic membrane
Synapse
Receptors
Neurotransmitters

Why the membrane of a neuron is polarised?
Mark the wrong statement

1. The outer surface of the axonal membrane possesses a positive charge while its inner surface is negatively charged
2. The axoplasm inside the axon contains high concentration of K^+ and negatively charged proteins and low concentration of Na^+
3. The fluid outside the axon contains a low concentration of K^+, and high concentration of Na^+, forming a concentration gradient
4. A resting membrane is comparatively more permeable to Na^+ and nearly impermeable to K^+

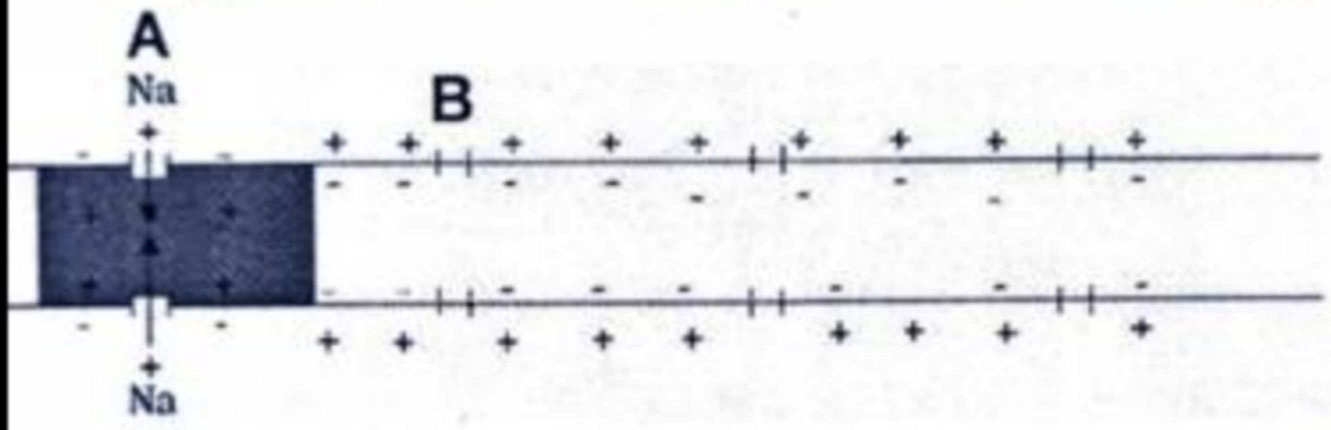
Ans -4

If the Na^+— K^+ pump is blocked then

1. Na^+ and K^+ will be excess in extracellular fluid
2. Excess amount of Na^+ in extracellular fluid
3. Excess amount of K^+ in intracellular fluid
4. Excess amount of Na^+ in intracellular fluid

Ans -4

Read the following statement about the diagram and select the correct statement(s) :



(a) The electrical potential difference at the site A is called the action potential

(b) A current flows on the outer surface from site A to site B. On the inner surface current flows from site B to site A to complete circuit of current flow.

(c) During depolarisation inner side of plasma membrane become positive w.r.t. outer side

(d) During repolarisation inner side of plasma membrane become negative w.r.t. outer side.

1. Only (a) and (b)
2. Only (a) and (c)
3. Only (a), (c) and (d)
4. Only (a), (b), (c) and (d)

Ans -3

1. The two major divisions of human neural system are

A) CNS and brain
B) ANS and PNS
C) CNS and PNS
D)Brain and spinal cord

2. Consider the following statements.

(A) Central nervous system is the major site of information processing.

(B) Central nervous system is composed of brain and cranial nerves.

Select the correct option.

A) A is true, B is false.
B) A is false, B is true.
C) Both A and B are true.
D) Both A and B are false.

3. The major structural component of peripheral nervous system is

A) spinal cord
B) nerves
C) visceral organs
D) all of these

4. The nerve fibres of PNS are

A) Afferent
B) efferent
C) both afferent and efferent
D) only motor

5. Consider the following statements.

I. Two major division of CNS are somatic neural system and autonomic neural system.

II. Both somatic and autonomic neural system are antagonistic in their functions.

Select the correct option.

A) I is true, II is false.
B) Both I and II are true.
C) I is false, II is true.
D) Both I and II are false.

6. Select the correct statement.

A) Somatic neural system consists of both afferent and efferent nerves.
B) Autonomic neural system consists of only afferent fibres.
C) Only efferent nerves are found in somatic and autonomic neural system.
D) Both afferent and efferent fibres are found in somatic and autonomic neural system.

7. The two divisions of autonomic nervous system are

A) antagonistic to each other
B) complementary to each other
C) highly reduced and non-functional in humans
D) functional as a single system in humans

8. The basic structural components of a neuron are
A) cell body and axon
B) cell body and dendrites
C) axon and dendrites
D) cell body, axon and dendrites

9. Identify the incorrectly matched pair of cell organelle found in neuron and its function.
A) Nucleus – Contain DNA
B) Mitochondria – Energy production
C) Golgi apparatus – Protein synthesis
D) Lysosomes – Scavengers of neurons

10. Neurons differ from a typical cell because of the presence of
A) nucleolus
B) Nissl's granules
C) protein synthesizing machinery
D) Microfilaments

11. Nissl bodies are mainly composed of
A) proteins and lipids
B) DNA and RNA
C) nucleic acids and SER
D) free ribosomes and RER

H.W.

1. Synapse is a junction between.
A) two neurons
B) CNS and PNS
C) spinal cord and nerves
D) cell body and axon

2. Select the incorrect statement.
A) Synaptic cleft is not necessarily found between all the neurons.
B) At synapse, the impulse travels along the single direction, i.e., from pre-synaptic to post synaptic membrane.
C) Electrical synapses are rare in human body.
D) Chemical synapses are faster than the electrical synapses.

3. The chemicals found in the synaptic cleft are known as..
A) Prohormones
B) hormones
C) Neurotransmitters
D) Proenzymes

4. The neurotransmitter-filled synaptic vesicles are found in
A) post synaptic membranes
B) receptor sites of post-synaptic vesicles
C) axon-terminal
D) tips of dendrites

5. Receptor sites for neurotransmitters are present on

A) membranes of synaptic vesicles
B) pre-synaptic membrane
C) tips of axons
D) post-synaptic membranes

6. The opening of ion-channels on post- synaptic membrane generates

A) excitatory potential
B) inhibitory potential
C) either (a) or (b)
D) no action potential

7. Assertion: Neurons are excitable cells.

Reason: The membrane of neurons remain in polarised state.

A) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
C) Assertion is true, but Reason is false.
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8. Consider the following statements.

(A) Brain is the central control system of human body.

(B) Brain can control both voluntary movements and functioning of vital involuntary organs.

Select the correct option.

A) A is true, B is false.
B) Both A and B are false.
C) A is false, B is true.
D) Both A and B are true.

THANK YOU !!

MANTHAN NEET 2025

NEURAL CONTROL AND CORDINATION

LECTURE - 4

ZOOLOGY



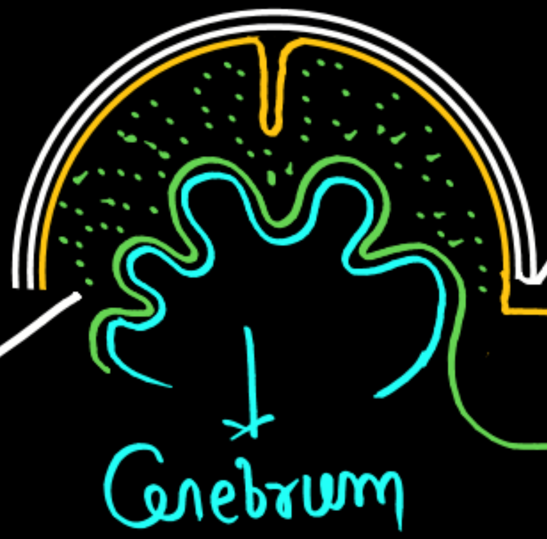
MD SIR

❑ TODAY'S GOAL -

- ❑ CENTRAL NEURAL SYSTEM – BRAIN ✓

(B.M.S)

Covering of Brain



Outer = Duramater < Double, Avascular

Middle = Arachnoid → tqt only in Mammals

Inner = Piamater → Connect with Cerebrum

Sub-arachnoid Space

Contain → C.S.F

C.S.F = Cerebro Spinal Fluid

Human Brain

(1) Fore Brain
(Prosencephalon)

- Telencephalon
  - Cerebrum
  - olfactory lobe
  - Hyppocampus
  - Amygdala
- Diencephalon
  - Hypothalamus
  - Thalamus
  - Epithalamus

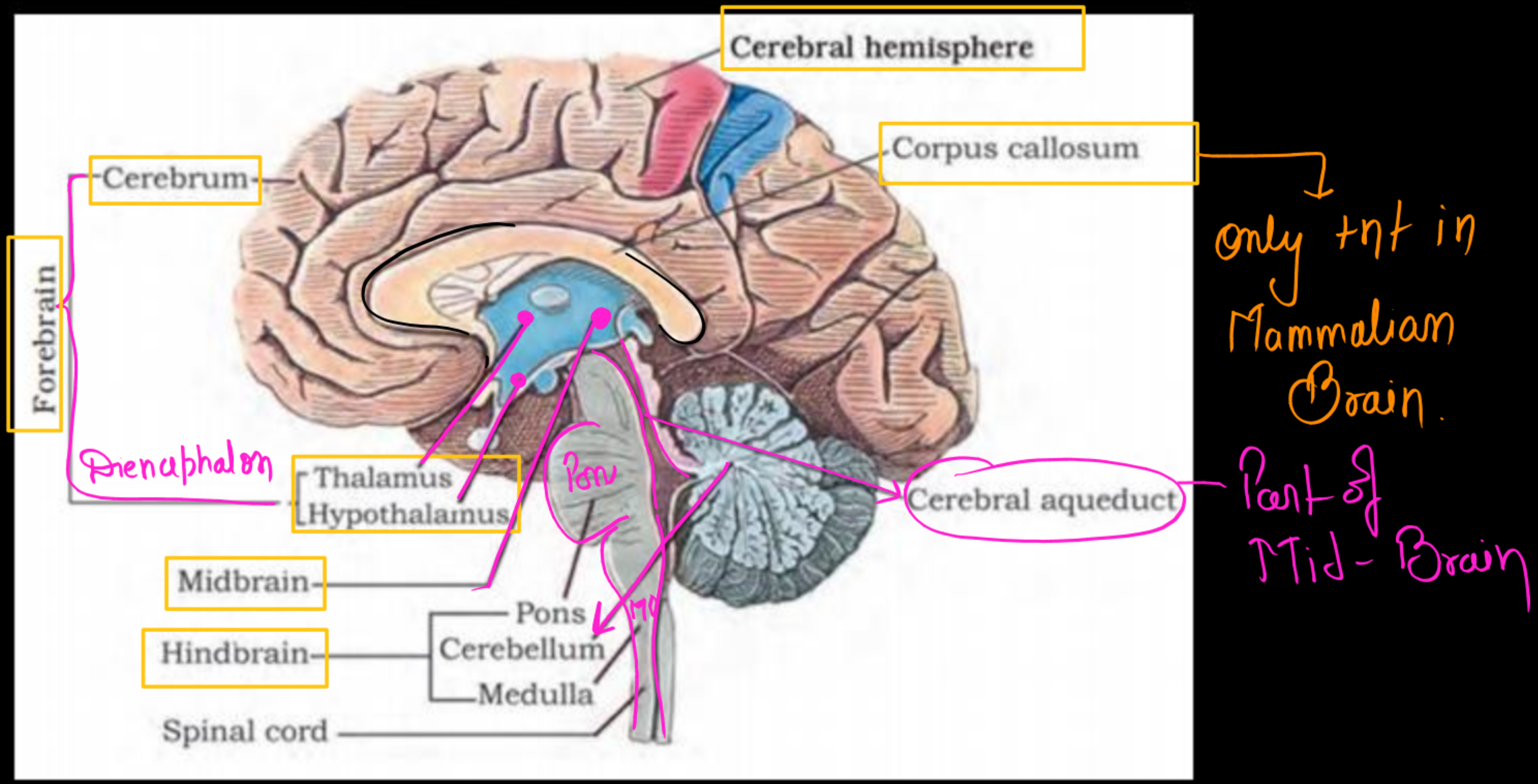
Hyppocampus, Amygdala, Hypothalamus, Thalamus → [H.A.T. of Hippo.] Limbic System [Emotional Brain]

(2) Mid Brain
(Mesencaphalon)

- Corpora Quadrigemina [Position = Dorsal]
  - Two-Supper Colliculi = Visual Reflex
  - Two-Inferior Colliculi = Auditory Reflex
- Cerebral Aqueduct → Duct which Connect Fore Brain with Hind brain

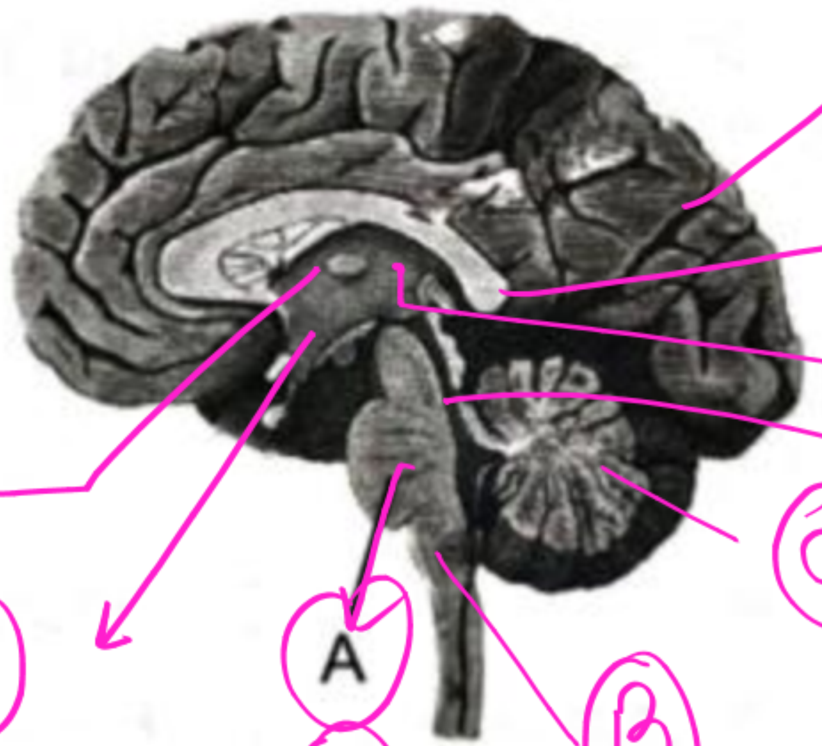
(3) Hind Brain
(Rhombincephalon)

- Mylin Cephalon = M.O.
- Metencephalon = Pons + Cerebellum



Cerebral hemisphere
Corpus callosum
Cerebrum
Forebrain
Diencephalon
Thalamus
Hypothalamus
Midbrain
Pons
Hindbrain
Cerebellum
Medulla
Spinal cord
Cerebral aqueduct
only tnt in Mammalian Brain.
Part of Mid-Brain

. In the given diagram, identify A.



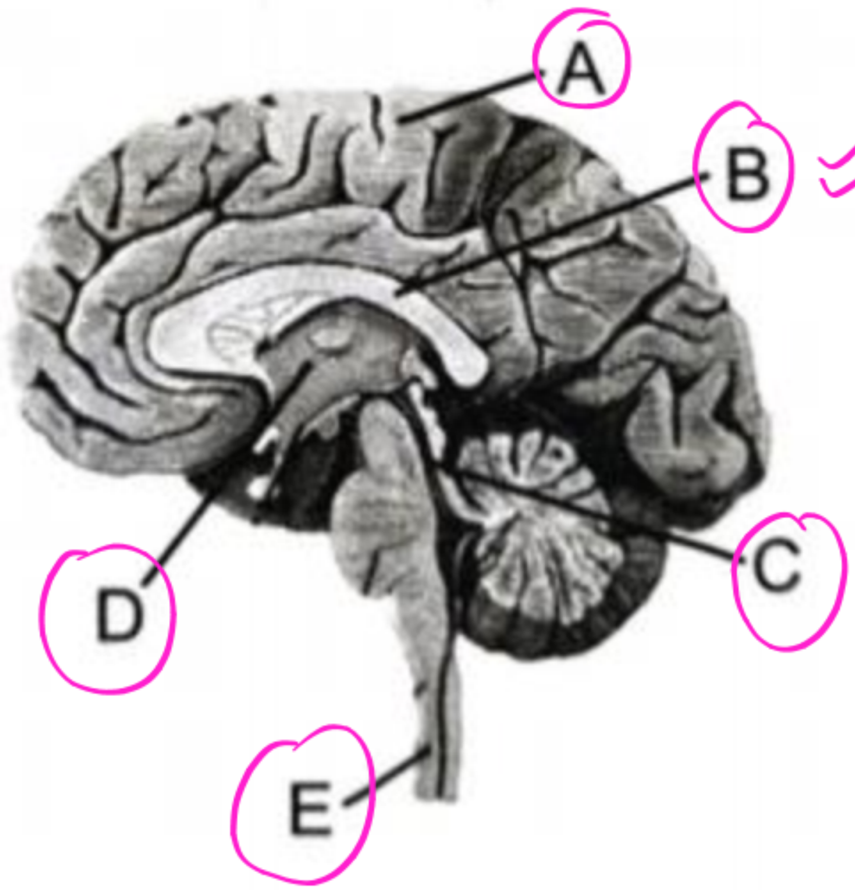
(1) Cerebrum

(2) Cerebellum

(3) Medulla oblongata

(4) Pons

Which of the labelled structure is absent in non-mammalian brain?



(1) D
(2) E
(3) C and A
(4) B

(1) Fore Brain

1) → Cerebrum → Largest Part of Brain which form by two equal half Called = Cerebral hemisphere



[Outer = Cortex]

- Highly folded Structure
- It is a Collection of layer of Cyton
- which form Grey Matter

[Inner = Medulla]

- It is a Collection myelinated Axon
- Which form White Matter.

Corpus Callosum → Thick bundle of Neurons, which Connect & Coordinate both hemisphere.

→ only +nt in Mammalian brain.

Function of lobes of Hemisphere → **Frontal lobe**

- Memory, Learning, Reasoning, Creative ideas etc.
- Motor-Speech area [Brocas area]



Parietal lobe (Sensory)

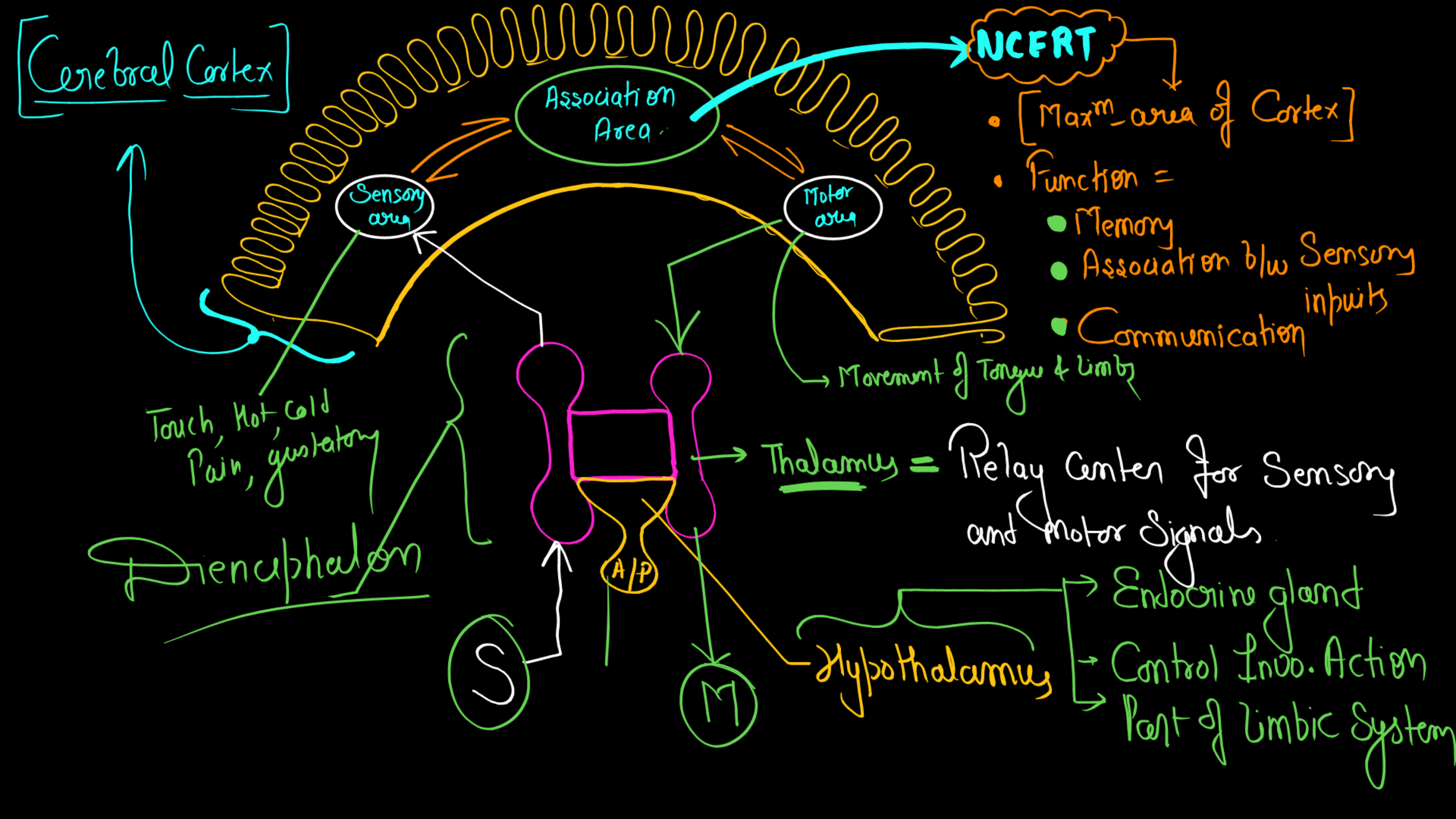
Touch, Hot, Cold, Pain

Taste / Gustatory.

Temporal lobe

- Sensory Speech area [Wernick's area]
  - → Auditory
  - → Olfactory

Occipital lobe → Visual



Cerebral Cortex
Association Area
NCERT
• [Maxm area of Cortex]
• Function =
• Memory
• Association b/w Sensory inputs
• Communication
Sensory area
Motor area
Movement of Tongue & Limbs
Touch, Hot, Cold
Pain, gustatory
Diencephalon
Thalamus = Relay Center for Sensory and Motor Signals
A/P
S
M
Hypothalamus
Endocrine gland
Control Invo. Action
Part of Limbic System

Function of Hypothalamus –

- The hypothalamus contains a number of centres which control body temperature, urge for eating and drinking. It also contains several groups of neurosecretory cells, which secrete hormones called hypothalamic hormones.
- The inner parts of cerebral hemispheres and a group of associated deep structures like amygdala, hippocampus, etc., form a complex structure called the limbic lobe or limbic system. Along with the hypothalamus, it is involved in the regulation of sexual behaviour, expression of emotional reactions (e.g., excitement, pleasure, rage and fear), and motivation.

Mood, Love, etc.

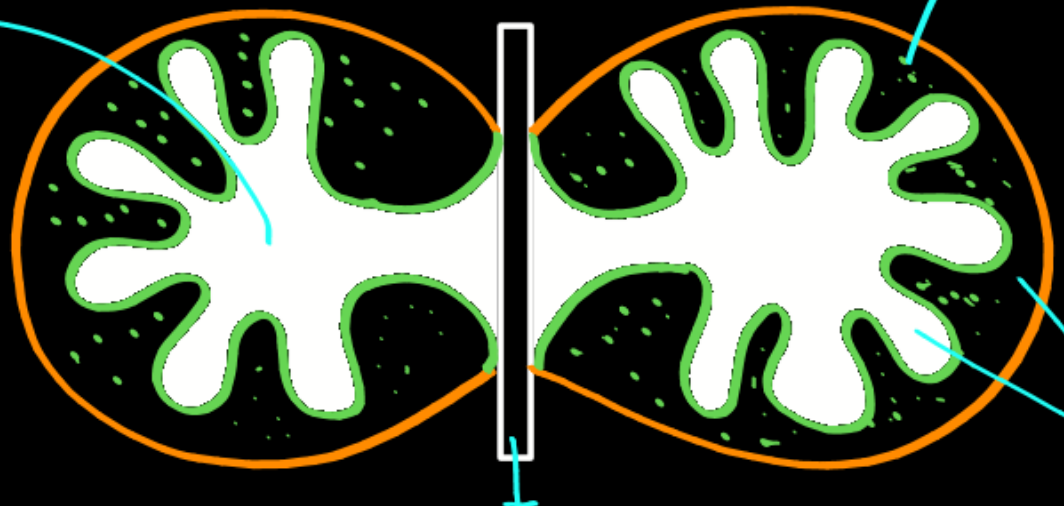
(2) Midbrain -

The midbrain is located between the thalamus/hypothalamus of the forebrain and pons of the hindbrain. A canal called the cerebral aqueduct passess through the midbrain. The dorsal portion of the midbrain consists mainly of four round swellings (lobes) called corpora quadrigemina.

(3) Hind Brain -

1) - Cerebellum = 2^{nd} - Largest Part of brain

Medulla
[White Matter]



Outer = Cortex
- Highly folded
- Grey Matter

Arbor Vitae
[Branch of Tree like Structure]

Vermis
[Thick Bundle of Neurons]

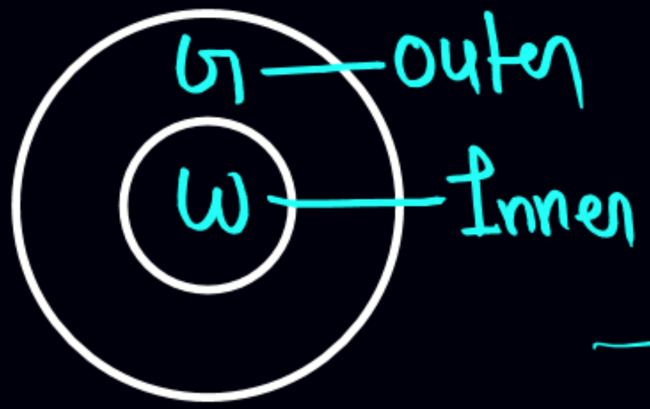
Function = Balancing & Cordination of body Movement.

2) - Medulla oblongata → Control Involuntary action & body System - Digestive etc.
→ Body Reflex

Note → Brain Stem → = Mid Brain + Hind Brain
- Pons
- M.O.



Note - Position of Grey & White Matter in CNS ⇒



eg - Forebrain + Cerebellum



Brain Stem + Spinal cord

H.W

1. Synapse is a junction between.
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B) CNS and PNS
C) spinal cord and nerves
D) cell body and axon

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(A) Brain is the central control system of human body.
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THANK YOU !!

MANTHAN NEET 1.0 & 2.0

CHEMICAL COORDINATION AND INTEGRATION

LECTURE - 1

ZOOLOGY



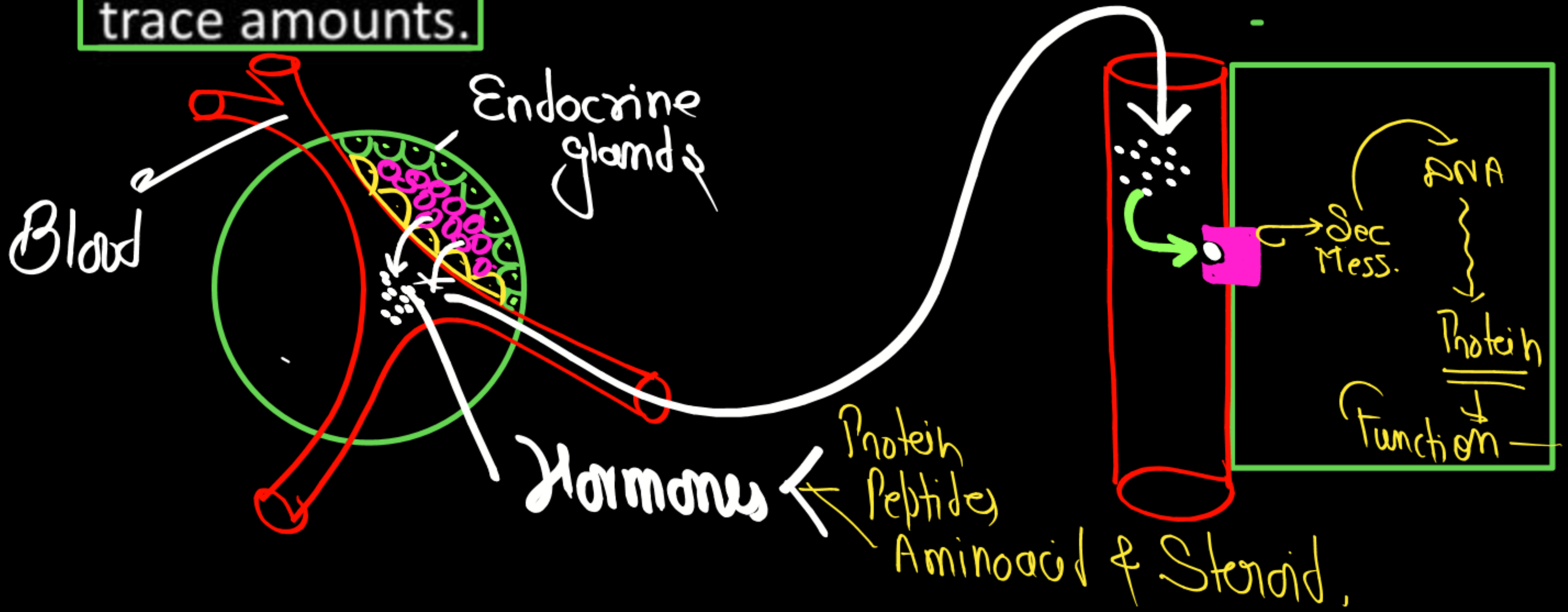
MD SIR

❑ TODAY'S GOAL -

- ❑ Pituitary ✓
- ❑ Hypothalamus ✓
- ❑ Pineal gland

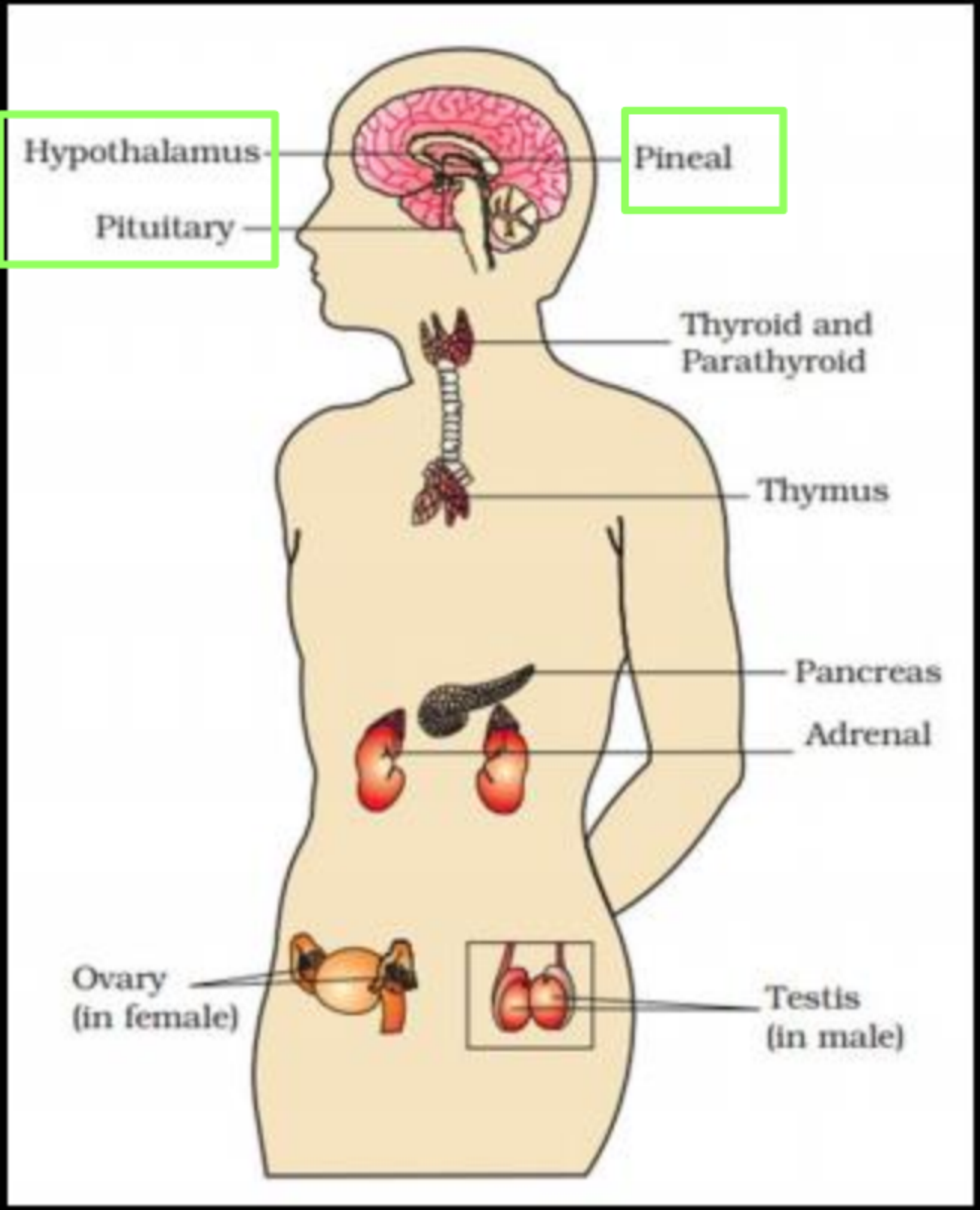
Endocrine Glands and Hormones

- The classical definition of hormone as a chemical produced by endocrine glands and released into the blood.
- Current scientific definition as follows: Hormones are non-nutrient chemicals which act as intercellular messengers and are produced in trace amounts.



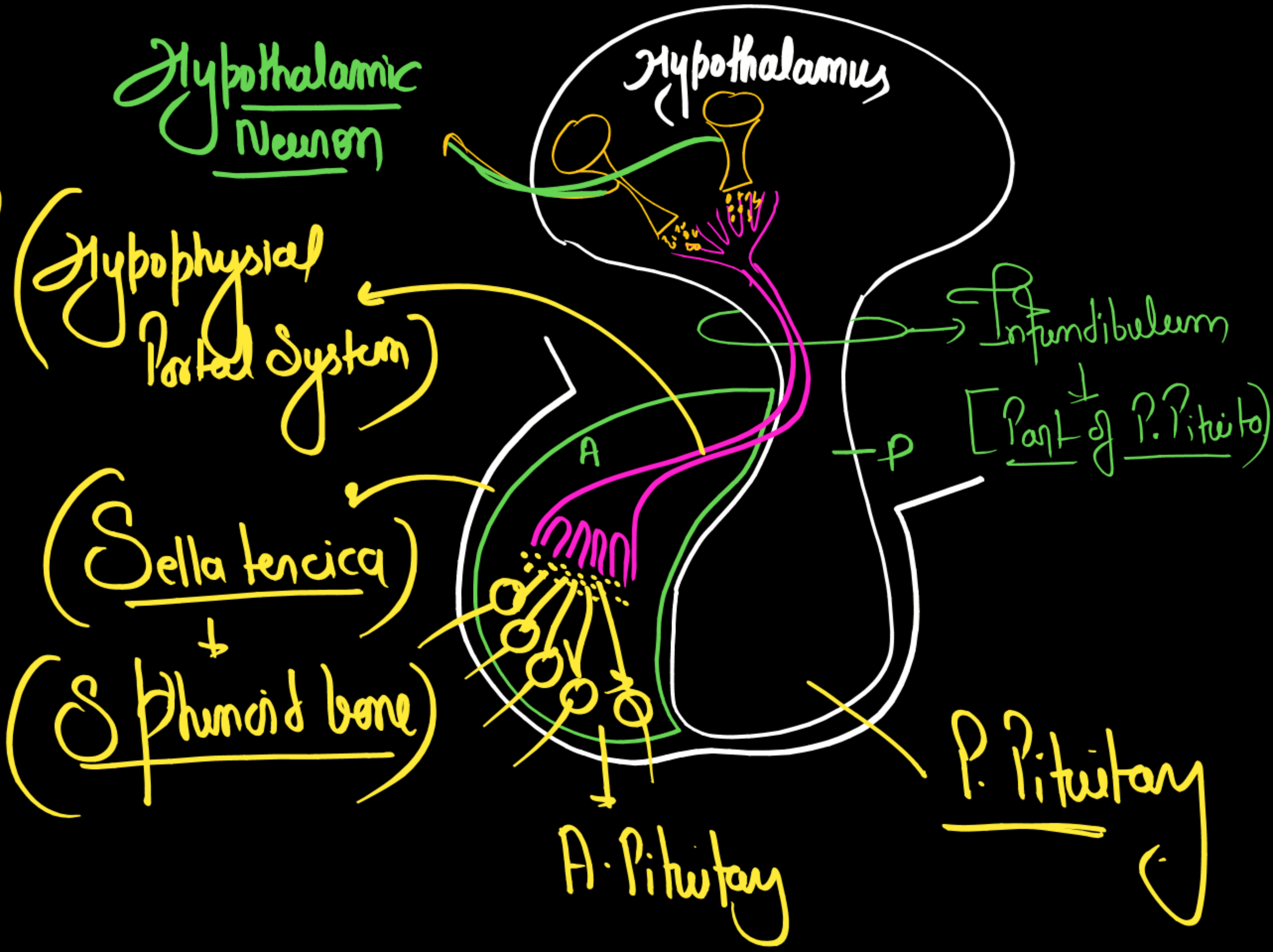
Human Endocrine System

- Pituitary, pineal, thyroid, adrenal, pancreas, parathyroid, thymus and gonads (testis in males and ovary in females) are the organized endocrine bodies in our body.
- In addition to these, some other organs, e.g., gastrointestinal tract, liver, kidney, heart also produce hormones.



Pituitary Gland

- Origin = Ectodermal
- Wt. = 0.5 gm.



Hypothalamic Neurons or [Neurosecretory Cells]

(Hypothalamus)



Supra optic Nuclei → A.D.H. (Vasopressin)

Para Ventricular Nuclei → (Oxytocin)

Anterior Pituitary or [Adenohypophysis]

- Pars Distalis
- Pars Intermedia + Middle lobe } Part of A. Pituitary

→ 5 - Trophic Cells

Posterior Pituitary or [Neurohypophysis]

- [ADH] or Vasopressin
- Oxytocin

Both produced by ⇒ Hypothalamus

Trophic cells →

1) → Somatotrophic cells → Growth Hormone (G.H / S.T.H) ✓

2) → Thyrotrophic cells → T.S.H → Stimulate Thyroid → Release T3/T4 Thyroxin ✓

3) → Corticotrophic cells →
   - A.C.T.H → Stimulate Adrenal Cortex → Cortisol ✓
   - M.S.H ✗

4) → Gonadotrophic cells →
   - L.H
   - F.S.H

   → Stimulate gonads

5) → Lactotrophic cells → Prolactin (P.R.L) →
   - Development of Memmary glands. ✓ (Memotrophic Hormone)
   - Formation of Milk ✓ (Lactogenic Hor)

1) - Growth Hormones → (G.H./S.T.H.)

Disorders →

(Hyposecretion)

1) Pituitary Dwarfism or (Midget)

Mentally & Sexually } Normal

(Hypersecretion)

2 = Gigantism (Hyper in childhood)

2 = Acromygali (Hyper in Adult)

Function →

- G.H. Stimulate Secretion of Growth Regulating Factors which Control Growth of → Cartilage, Bone, Body Tissue.
- Control Metabolism of Fat, Protein & Carbohy. & ↑ - Blood glucose level.

Note - Dibetogenic Effect →

If = Hypersecretion of G.H. ⇒ ↑ - Blood glucose level.

2)- Gonadotrophic Hormones (A. Pituitary)

[Male]

- **L.H.** → [Leydig cells of Testis] → Release — Androgen [Testoston]
- **F.S.H.** → [Sertoli cells of Testis] → Sperm Maturation Factor

Testoston + Sperm Maturation Factor → (Spermatogenesis)

[Female]

- **F.S.H.** → (Development of Follicles in Ovary) → (↑ Estrogen) → Female Sex Hor.
- **L.H.** →
  - ⊙ Ovulation
  - ⊙ Formation of Corpus Luteum → ↑ - Progesteron, ↑ - Estrogen etc.

Posterior lobe of Pituitary. (Neurohypophysis)

Q.

A.D.H. (Vasopressin)

↓

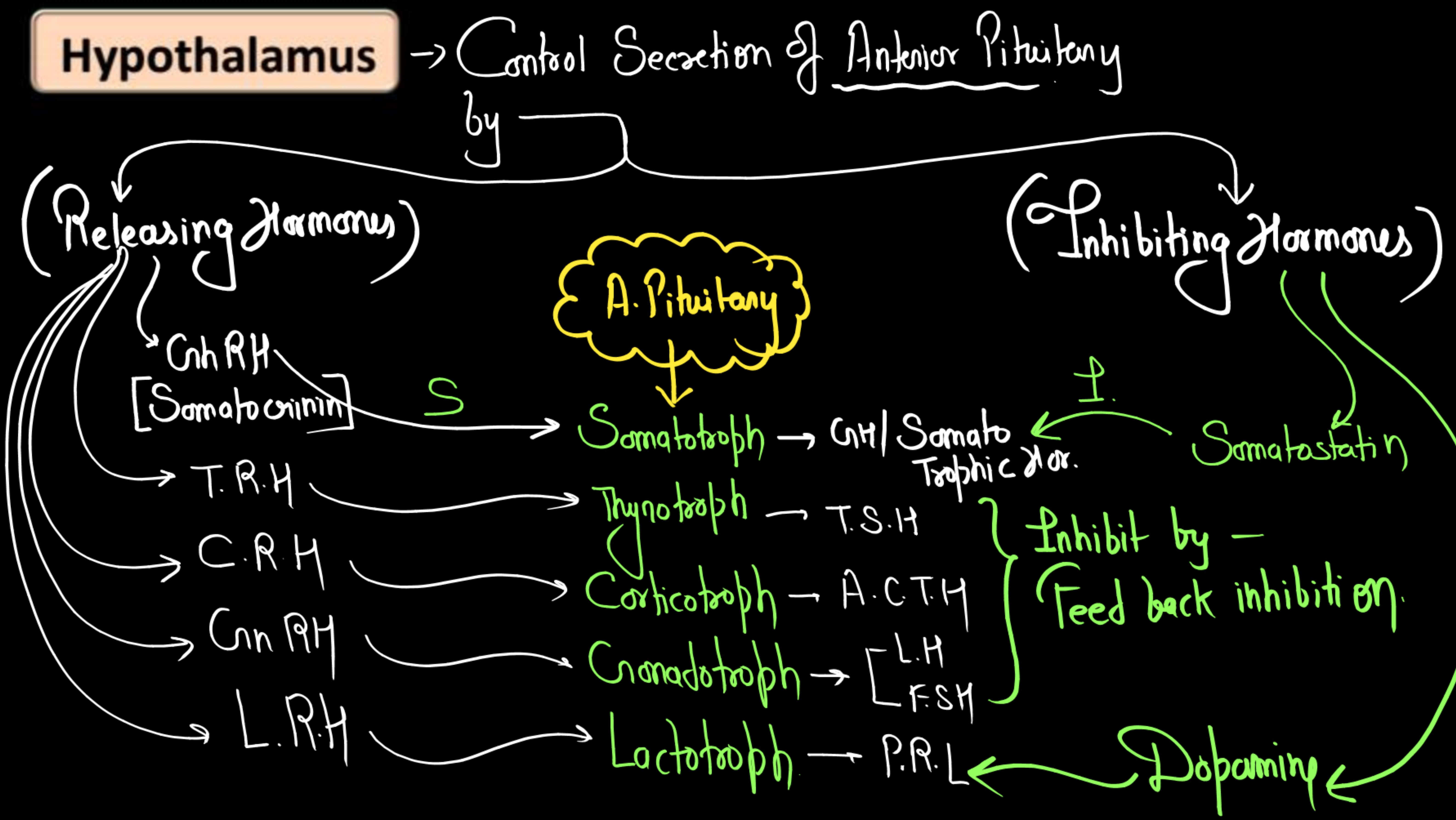
↑. absorption of Water from – D.C.T & C.D.

(Oxytocin)

↓

Contraction in Smooth Muscles of –

- → Mammary glands. → Ejection of Milk
- Uterine Wall → Parturition. (Birth)



Hypothalamus
Control Secretion of Anterior Pituitary
by
(Releasing Hormones)
(Inhibiting Hormones)
A. Pituitary
GhRH
[Somatocrinin]
S
Somatotroph → GH/Somato Trophic Hor.
I.
Somatostatin
T.R.H
Thyrotroph → T.S.H
C.R.H
Corticotroph → A.C.T.H
Gn RH
Gonadotroph → L.H, F.S.H
L.R.H
Lactotroph → P.R.L
Inhibit by –
Feed back inhibition.
Dopamine

H.W.

(1) Dwarfism occurs when there is:
(i) Over secretion of growth hormone
(ii) Under secretion of growth hormone
(iii) Over secretion of somatostatin
(iv) Under secretion of somatostatin
(A) (i) and (iii) (B) Only (ii)
(C) (ii) and (iii) (D) (ii) and (iv)

(2) Which of the following hormones is responsible for gigantism?
(A) Somatotrophin (B) Somatostatin
(C) Adrenaline (D) GnRH

(3) Which hormones are actually synthesized by the hypothalamus and are transported axonally to neurohypophysis?
(A) ACTH, TSH
(B) MSH, ADH
(C) ADH, GH
(D) Oxytocin, vasopressin

(4) Hypothalamus forms an important link between:

(A) Digestive system and nervous system
(B) Nervous system and respiratory system
(C) Nervous system and endocrine system
(D) Integumentary system and reproductive system

(5) Adenohypophysis in humans consists of two portions:
(A) Pars distalis and Pars nervosa
(B) Pars intermedia and Pars distalis
(C) Pars nervosa and Pars intermedia
(D) Anterior and posterior pituitary

(6) The anterior pituitary hormone that does not stimulate another endocrine gland is:
(A) Somatotrophin
(B) Thyrotrophin
(C) Gonadotrophin
(D) Adrenocorticotrophin

(7) Which of the following can be heterocrine glands?

(1) Thyroid and parathyroid
(2) Pineal gland
(3) Gonads and pancreas
(4) Thymus

(8) The ductless glands

(1) Produce non-nutrient intercellular messengers
(2) Found only in non-chordates
(3) Are absent in human body
(4) Are called exocrine glands

(9) Which of the following is an incorrect statement?

(1) Hormones are non-nutrient chemicals
(2) Hormones are required in trace amounts
(3) Hormones are intra-cellular messengers
(4) Hormones are secreted by endocrine glandular cells

(10) Chemically hormones are

(1) Biogenic amines only
(2) Proteins, steroids and biogenic amines
(3) Proteins only
(4) Steroids only

(11) Which of the following statement is incorrect?
(1) The endocrine glands and hormone producing diffused tissues/cells located in different parts of our body constitute endocrine system
(2) Hormones regulate metabolism, growth and development of our organs
(3) Besides hypothalamus, pituitary, pineal, thyroid, adrenal, parathyroid, thymus, GIT, heart, kidney also produce hormones
(4) Hormone can be used again and again like biocatalyst

(12) Hypothalamus forms an important link between
(1) Digestive system and nervous system
(2) Nervous system and respiratory system
(3)Nervous system and endocrine system
(4) Integumentary system and reproductive system

13. The neurosecretory cells of hypothalamus which produce hormones are called

(1)	Nephrons	(2)	Nuclei
(3)	Granular cells	(4)	Globular cells

(14) Somatostatin from hypothalamus gland
(1) Activates the release of growth hormone
(2) Inhibits the release of growth hormone
(3) Inhibits the release of enzymes in the digestive tract
(4) Activates the release of enzymes pineal gland

(15)Which of the following is incorrect statement regarding hypothalamus?

(1) Hypothalamus is a basal part of mesencephalon
(2) It results wide spectrum of body function
(3) Neuro secretory cells of hypothalamus regulate the synthesis of pituitary hormones
(4) Both (2) and (3)

THANK YOU !!

MANTHAN NEET

CHEMICAL COORDINATION AND INTEGRATION

LECTURE - 2

ZOOLOGY



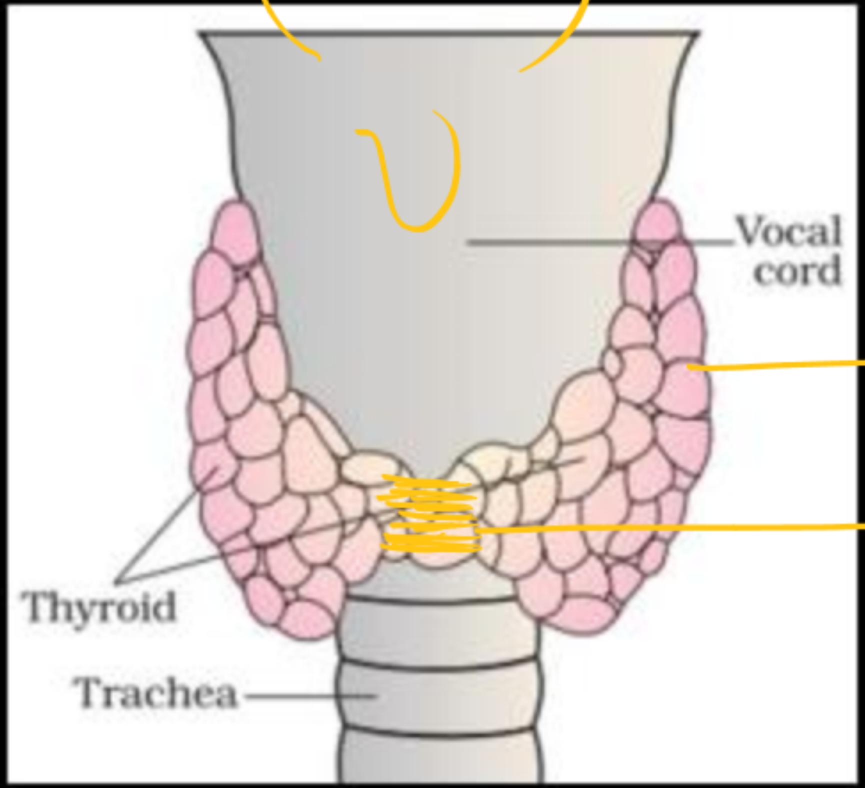
MD SIR

❑ TODAY'S GOAL -

- ❑ Thyroid and Parathyroid glands
- ❑ Pineal gland
- ❑ Thymus

Thyroid Gland

The thyroid gland is composed of two lobes which are located on either side of the trachea. Both the lobes are interconnected with a thin flap of connective tissue called isthmus. The thyroid gland is composed of follicles and stromal tissues.



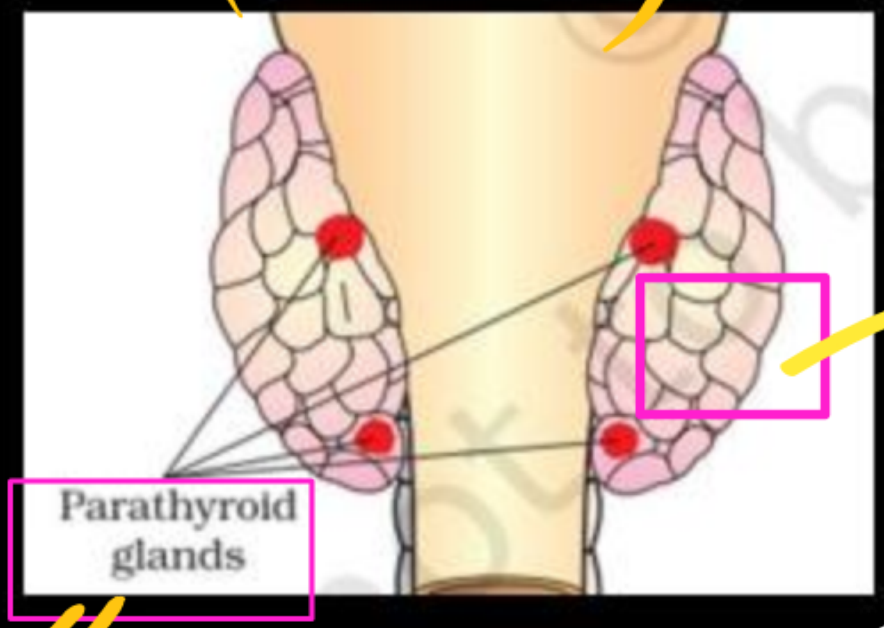
(Ventral)

Bilobed

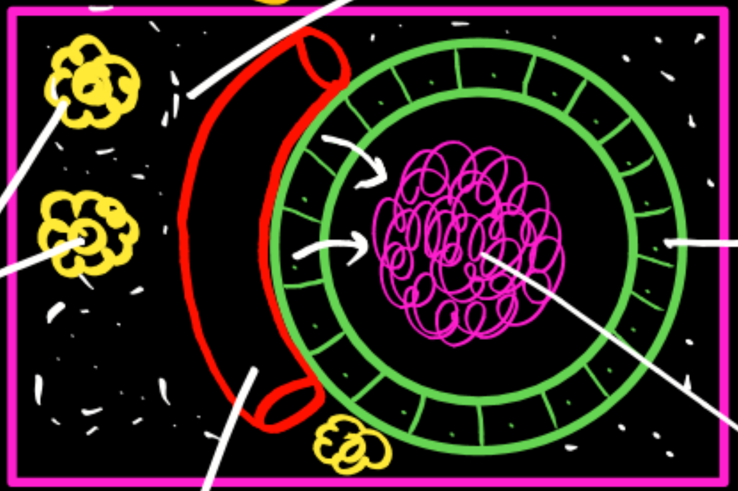
Isthmus (Connective Tissue)

Thin flap

(Dorsal)



T.S. of Thyroid



Stromal Tissue (Connective Tissue)

Follicles of Thyroid {Simple Cuboidal Epi. Tissue}

Thyroglobulin (Store form of Thyroxin)

(Blood Vessels)

[Parafollicular Cells of Thyroid]

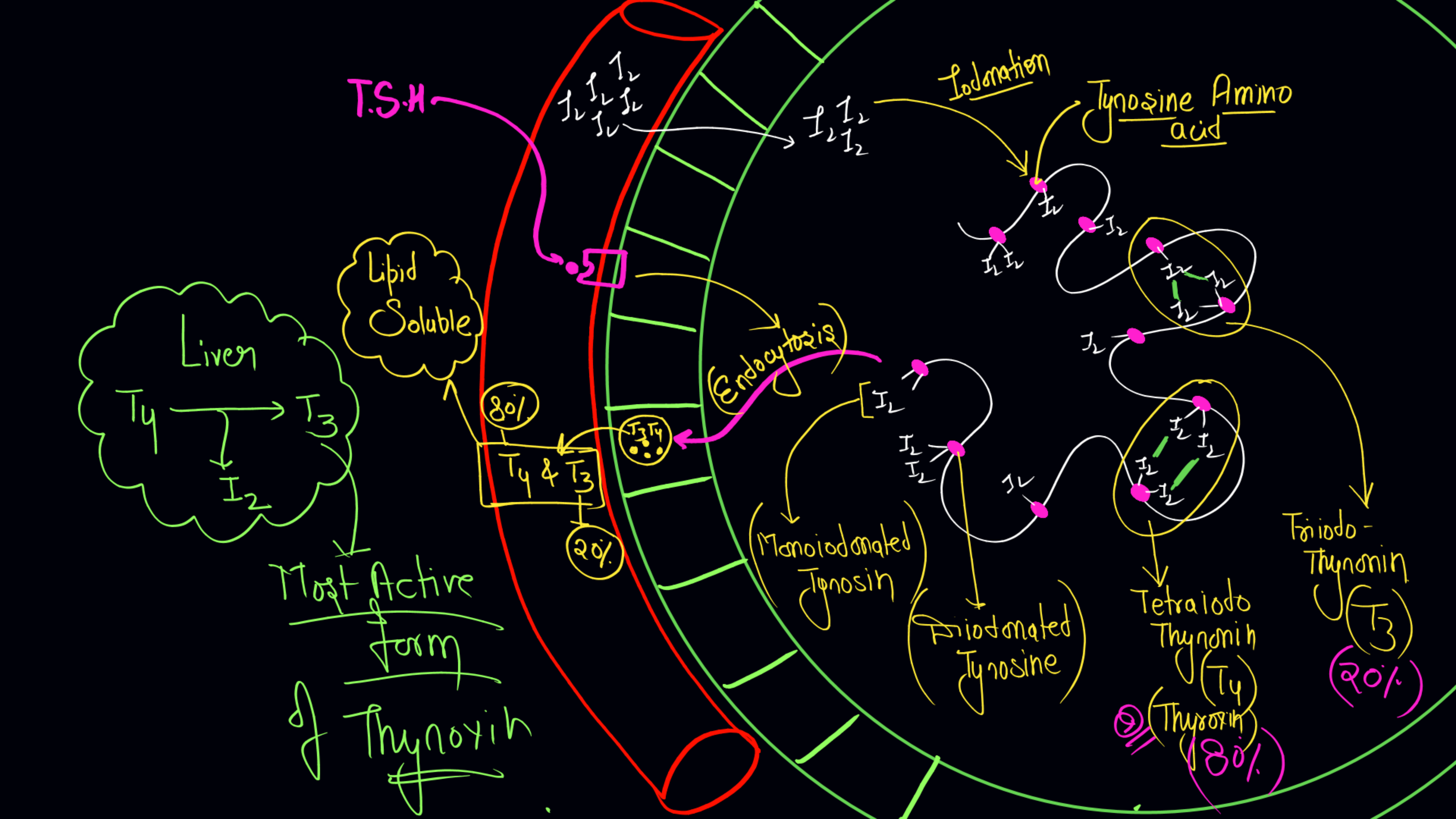
↓ Release

Thyrocalcitonin [T.C.T.]
+
[Hypocalcimic Hormone]

↓ Blood Ca^{++} level by —

1) - ↑ adsorption of Extra Ca^{++} in bone Matrix

2) - Elemenate Extra Ca^{++} from Kidney.



T.S.H
I2 I2 I2 I2 I2
I2 I2 I2 I2
Iodination
Tyrosine Amino acid
Endocytosis
Lipid Soluble
Liver
T4 → T3
I2
80%
T4 & T3
20%
T3 T4
Most Active form of Thyroxin
Monoiodonated Tyrosin
Diiodonated Tyrosine
Tetraiodo Thyronin
(T4)
(Thyroxin)
80%
Triiodo-Thyronin
(T3)
20%

Function of Thyroxin (T3 &T4) –

- Regulation of the basal metabolic rate.
- These hormones also support the process of red blood cell formation. → Erythropoisis
- Thyroid hormones control the metabolism of carbohydrates, proteins and fats. = ↑ - Blood Glucose level
- Maintenance of water and electrolyte balance.

Function of Thyrocalcitonin (TCT) –

- Regulates the blood calcium levels. = ↓ - Blood Ca^{++} level

Disorders of Thyroxin

[Hyposecretion]

1) - Simple Goiter → Enlargement of Thyroid — due to deficiency of I_2 in food.

2) - Critinism → Abnormal baby due to deficiency of - Thyroxin during Pregnancy → Abnormal baby —
- Low I.Q
- Deaf Mutism
- Retardation —
  - Sexually
  - Mentally
  - Physically.
- Thick Skin
- etc.

3) - In Adult Female → Irregular Menstrual Cycle.

(Hypersecretion)

1. Exophthalmic goiter [Grave's Diseases] ←
   - B.M.R = ↑
   - Thin body
   - Temp. = ↑

Parathyroid = [2-pairs] = one pair prst in each lobe of Thyroid.

↓

Release - Parathormone (P.T.H.)
(Hyper calcimic Hormone)

↓

{ ↑ - Blood Ca^{++} level }

↓

Stimulate

1) - Osteoclast cells (Macrophage)

↓

↑ - Breakdown / Demineralisation / Resorption of bone →

↓

↑ - Blood Ca^{++} level

J.G. Cells of Kidney

↓

Calcitriol (Vit-D_3)

↑ - absorption of Ca^{++} from gut food

Disorders

Q.

- Hyposecretion = ↓ Blood Ca^{++} level → Parathyroid tetany
- Hypersecretion = Osteoporosis.

Regulation of Blood Ca^{++} level →

Thyroid
↓
(T.C.T)
↓
↓ - Blood Ca^{++}

Parathyroid
↓
(P.T.H)
↓
↑ - Blood Ca^{++} level.

Q// Regulation of Blood Ca^{++} level.

H.W

1. The nervous and endocrine systems interact to coordinate the functions of all the body systems and help to maintain
A) homeostasis B) reflex actions
C) fight or flight response D) stress responses

2. Responses of the endocrine system are _______ and _______ than the responses of the nervous system.
A) rapid, long-lasting B) rapid, briefer
C) slower, long-lasting D) slower, briefer

3. Which of the following statements correctly differentiate the endocrine and nervous systems?
A) The endocrine system regulates all types of body cells.
B) Nerve fibers innervate all the body cell types.
C) Endocrine system acts on specific muscle cells only.
D) The influence of the nervous system is much broader.

4. Both neurotransmitters and hormones
A) produce a slower response. B) bind to receptors on or in their target cells.
C) are transported by interstitial fluid. D) produce a rapid response.

5. The hormones produced by hypothalamic nuclei
A) regulate the functions of the anterior pituitary.
B) regulate the functions of the posterior pituitary.
C) regulate the functions of both anterior and posterior pituitary.
D) inhibit the secretion of posterior pituitary hormones.

6. Which of the following statements about hypothalamic hormones is incorrect?
A) Hypothalamic releasing hormones stimulate the secretion of anterior pituitary hormones.
B) Hypothalamic releasing hormones stimulate the secretion of posterior pituitary hormones.
C) Hypothalamic inhibiting hormones inhibit the secretion of anterior pituitary hormones.
D) Somatostatin is a hypothalamic inhibitory hormone.

7. GnRH, a hypothalamic hormone, needed in reproduction, acts on
A) the posterior pituitary gland and stimulates secretion of LH and relaxin.
B) the anterior pituitary gland and stimulates secretion of LH and oxytocin.
C) the anterior pituitary gland and stimulates secretion of LH and FSH.
D) the posterior pituitary gland and stimulates secretion of oxytocin and FSH.

8. Which of the following hypothalamic hormones is incorrectly matched with its function?

A) TRH: Stimulates secretion of thyrotropin
B) PIH: suppresses the secretion of prolactin
C) GH-RH: stimulates secretion of growth hormone
D) CRH: stimulates the release of prolactin

9. The pituitary gland is a pea-shaped gland that lies in the hypophyseal fossa of
A) sella turcica of the glenoid bone
B) sella turcica of the sphenoid bone
C) sella turcica of the parietal bone
D) sella turcica of the frontal bone

10. The pituitary gland is connected to the hypothalamus by
A) infundibulum
B) bony cavity
C) hyaline cartilage
D) elastic cartilage

11. Malfunctioning of endocrine gland deviates the body from homeostasis and causes several disorders. Which of the following disorder is correctly matched with its respective endocrine gland?
A) Gigantism: Hyposecretion of growth hormone
B) Dwarfism: Hypersecretion of growth hormone
C) Acromegaly: Hypersecretion of growth hormone
D) Gigantism: Hypersecretion of somatostatin

12. Hypersecretion of growth hormone in adults does not cause a further increase in height, because
A) muscle fibers do not grow in size after birth.
B) growth hormone becomes inactive in adults.
C) epiphyseal plates close after adolescence.
D) bones lose their sensitivity to growth hormone in adults.

13. A person is diagnosed with hypersecretion of growth hormone due to a pituitary tumor. Select the incorrect statement about his medical condition.
A) Hypersecretion of growth hormone would cause hyperglycemia.
B) There will be a reduced secretion of insulin.
C) Insulin secretion would remain unaffected.
D) Hypersecretion of growth hormone results in a diabetogenic effect.

14. The target cells/structures of FSH and LH in human males are

A) interstitial cells and sertoli cells respectively.
B) sertoli cells and interstitial cells respectively.
C) interstitial cells only.
D) sertoli cells only.

15. LH is required for fertility in females because
A) it maintains corpus luteum.
B) it induces ovulation.
C) it stimulates the release of FSH from corpus luteum.
D) both (a) and (b).

16. Which of the following hormone is incorrectly matched with its target organ/cells?
A) MSH: melanocytes
B) Oxytocin: Smooth muscles
C) Vasopressin: distal tubules of kidneys
D) ADH: Glomerulus

THANK YOU !!

MANTHAN NEET

CHEMICAL COORDINATION AND INTEGRATION

LECTURE - 3

ZOOLOGY



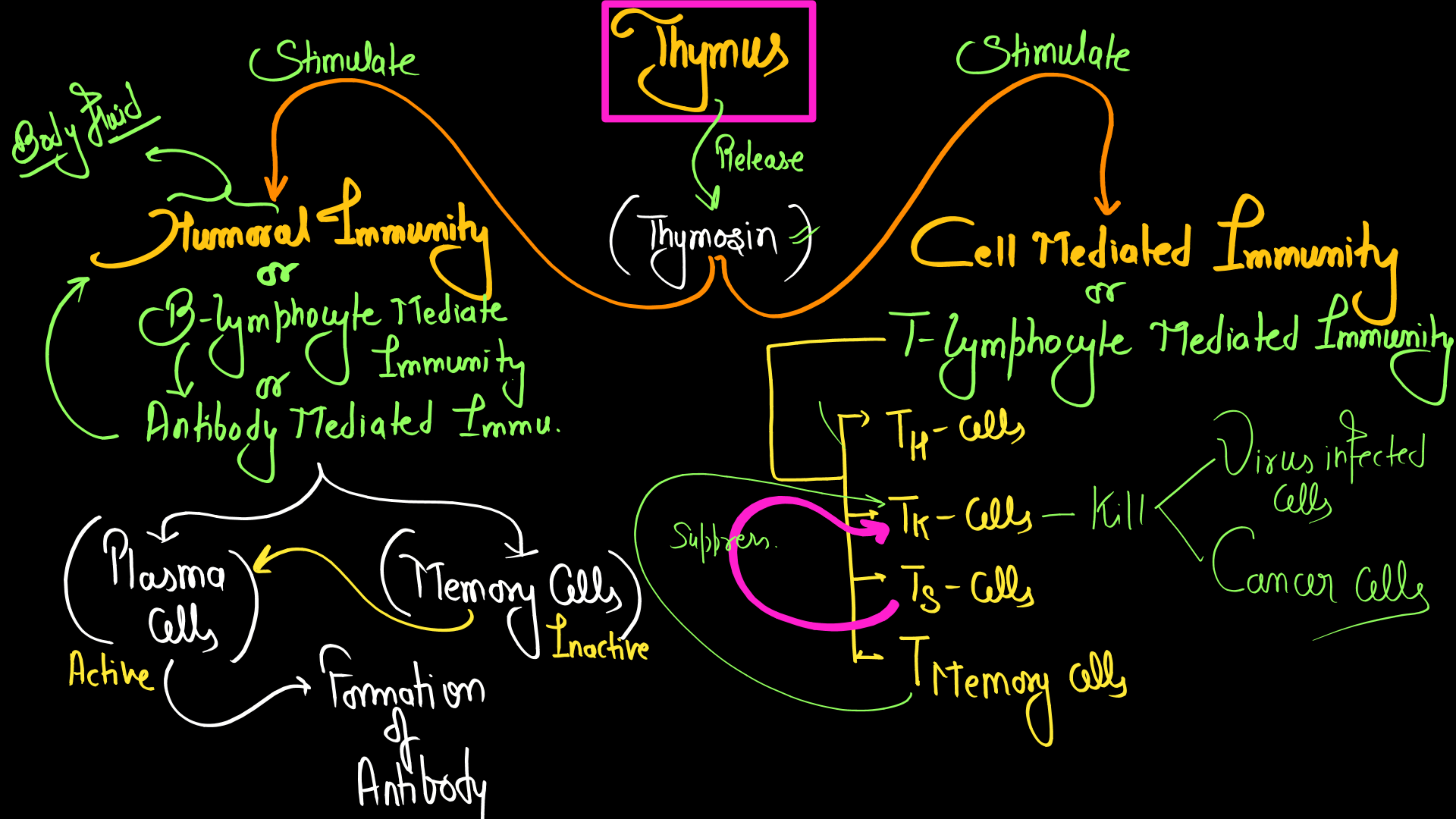
MD SIR

❑ TODAY'S GOAL -

- ❑ Thymus ✓
- ❑ Pineal glands ✓
- ❑ Pancreas ✓
- ❑ Adrenal Gland ✓

THYMUS GLAND

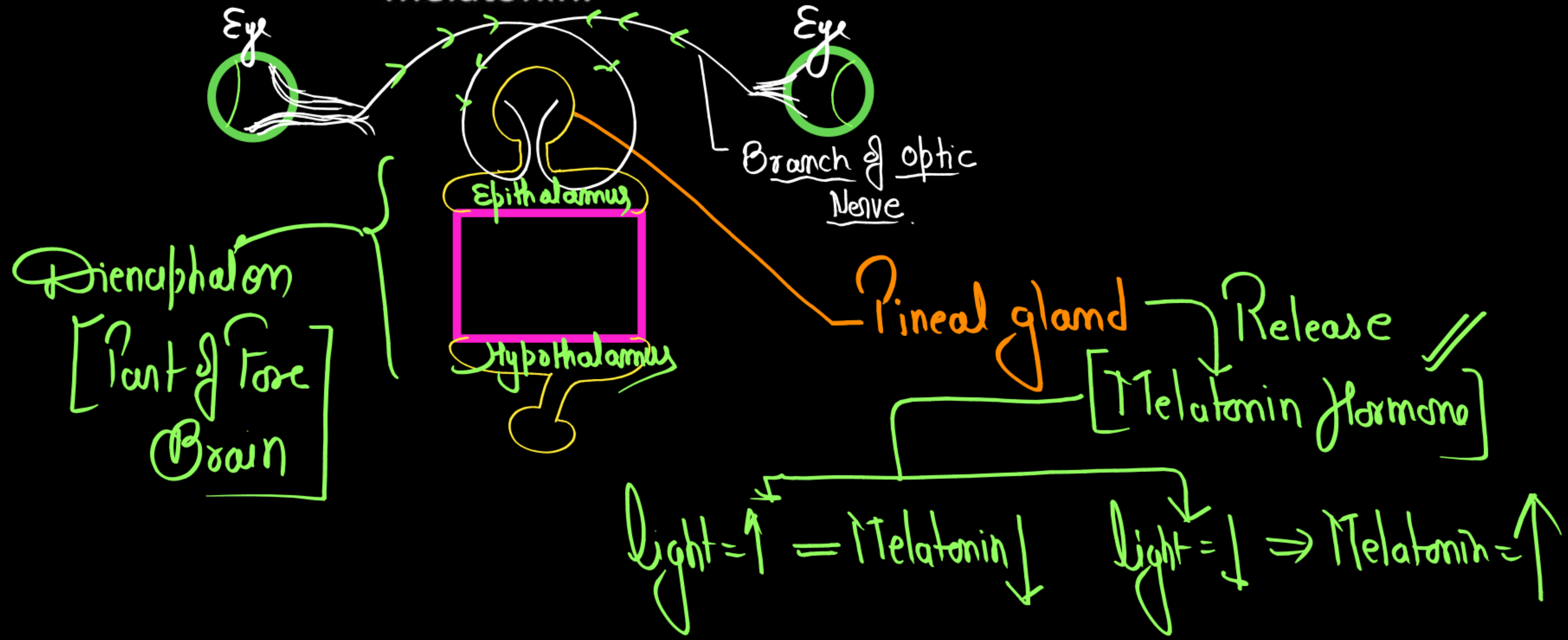
- The thymus gland is a lobular structure located between lungs behind sternum on the ventral side of aorta.
- This gland secretes the peptide hormones called thymosins.
- Thymus is degenerated in old individuals resulting in a decreased production of thymosins. As a result, the immune responses of old persons become weak.



Thymus
Release
(Thymosin)
Stimulate
Stimulate
Body fluid
Humoral Immunity
or
B-lymphocyte Mediate Immunity
or
Antibody Mediated Immu.
Plasma cells
Active
Memory cells
Inactive
Formation of Antibody
Cell Mediated Immunity
or
T-lymphocyte Mediated Immunity
TH - cells
TK - cells - Kill
Virus infected cells
Cancer cells
Suppress.
TS - cells
T Memory cells

Pineal Gland

The pineal gland is located on the dorsal side of forebrain. Pineal secretes a hormone called melatonin.



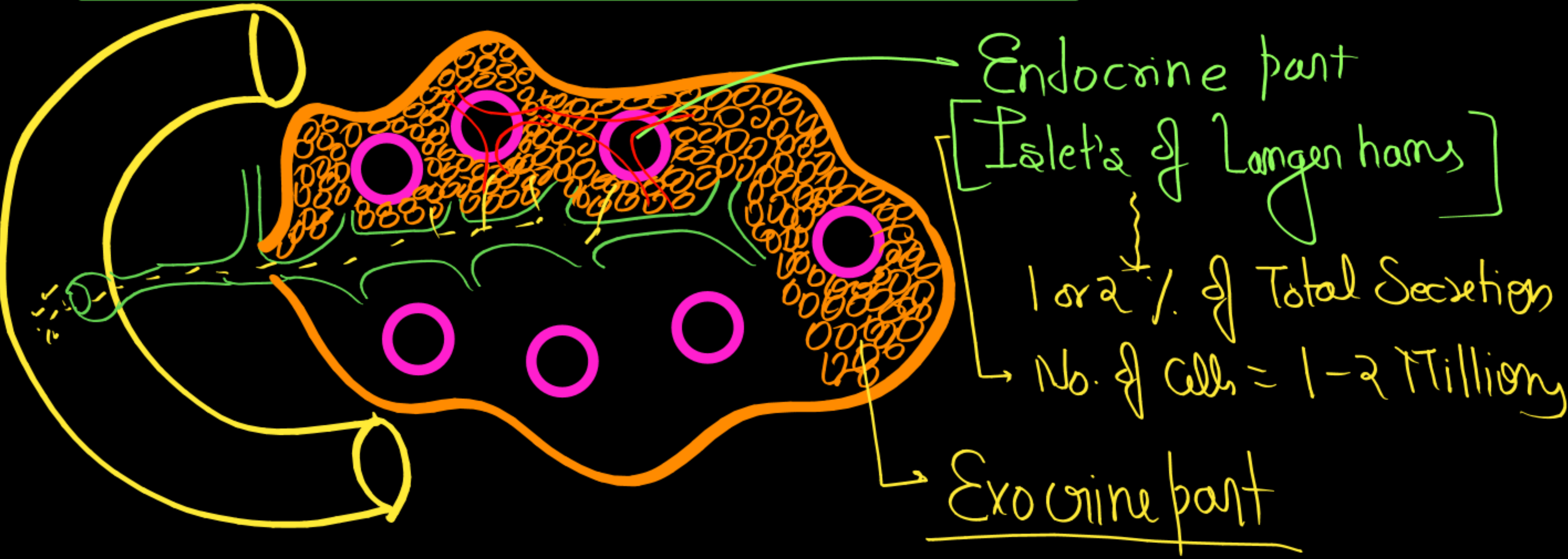
Function of Melatonin –

- Melatonin plays a very important role in the regulation of a 24-hour (diurnal) rhythm of our body / normal rhythms of sleep-wake cycle
- Body temperature
- Influences metabolism
- Pigmentation
- Menstrual cycle
- Our defense capability.

Pancreas

Hetero-crine gland

- Pancreas is a composite gland, which acts as both exocrine and endocrine gland.
- The endocrine pancreas consists of 'Islets of Langerhans'. There are about 1 to 2 million Islets of Langerhans in a normal human pancreas representing only 1 to 2 per cent of the pancreatic tissue.





Blood Vessels

[α - Cells]

{ Release

(Glucagone Hormonu)

↑ - Blood Glucose level

[Hyperglycemic Hor.]

- → Glycogenolysis (Glycogen ⟶ Glucose)
- Gluconeogenasis - Fat or - Protein ⟶ Glucose
- ↓ Uptake of Glucose in Cells

[β - Cells]

[Release - Insulin]

↓ - Blood Glucose level

[Hypoglycemic Hor.]

by - ↑ - Cellular Uptake of Glucose or

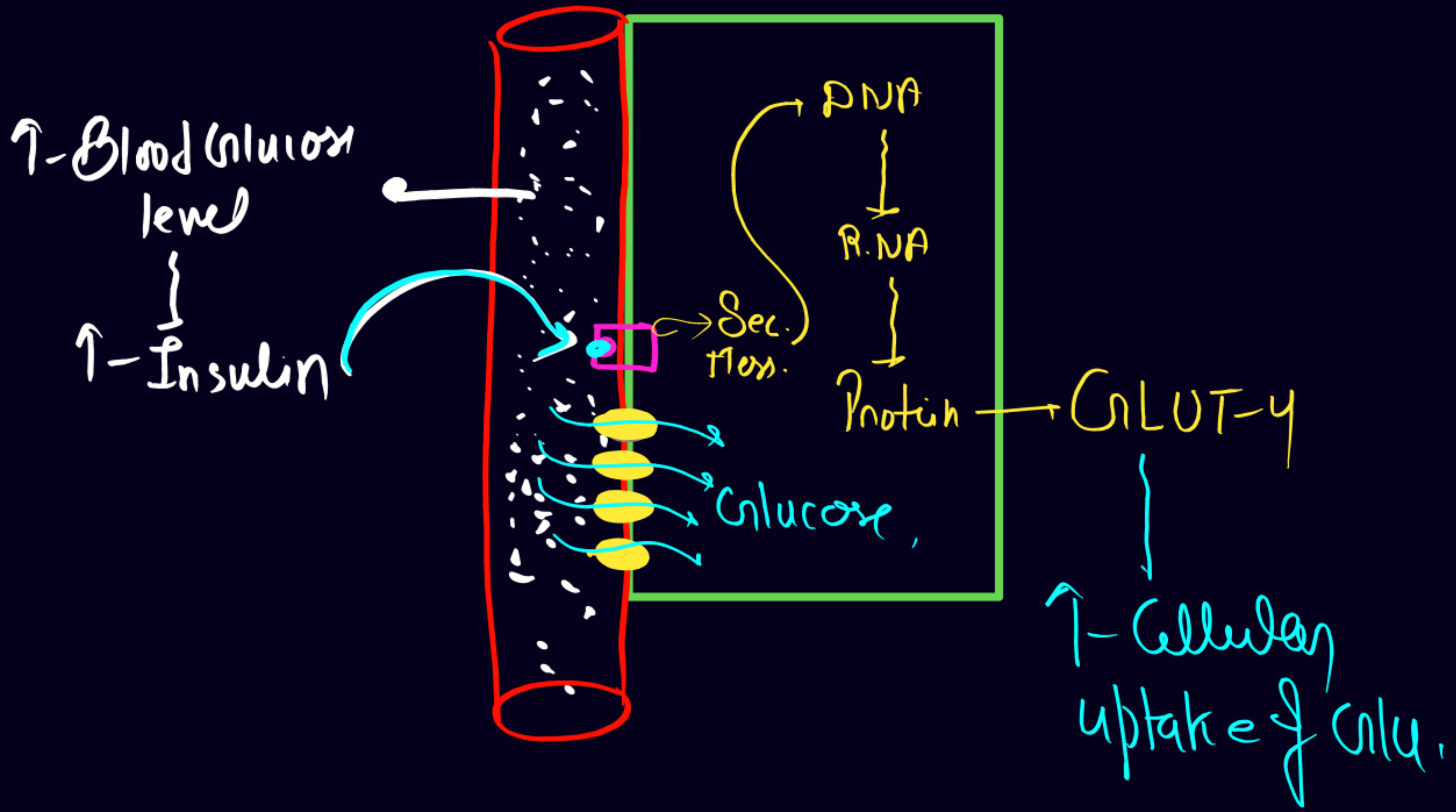
↑ - Permeability of Cells for Glucose

[δ - Cells]

Release Somatostatin

[Inhibitory Hormone]

Inhibit
- α - Cells
- β - Cells


↑- Blood Glucose level
↑- Insulin
Sec. Mess.
DNA
R.NA
Protein
GLUT-4
Glucose
↑- Cellular uptake of Glu.

In case of Diabetes Mellitus $\Rightarrow$ $\uparrow$ - Blood Glucose level [Hyperglycemia]

Glucoseurea = $\uparrow$ - Glucose in urine.

$\downarrow$

Polyurea = $\downarrow$ Interval b/w urination (Diuresis)

$\downarrow$

Polydipsia = $\uparrow$ - Thirst (Dehydration)

$\downarrow$

Polyphagia = $\uparrow$ - Hunger

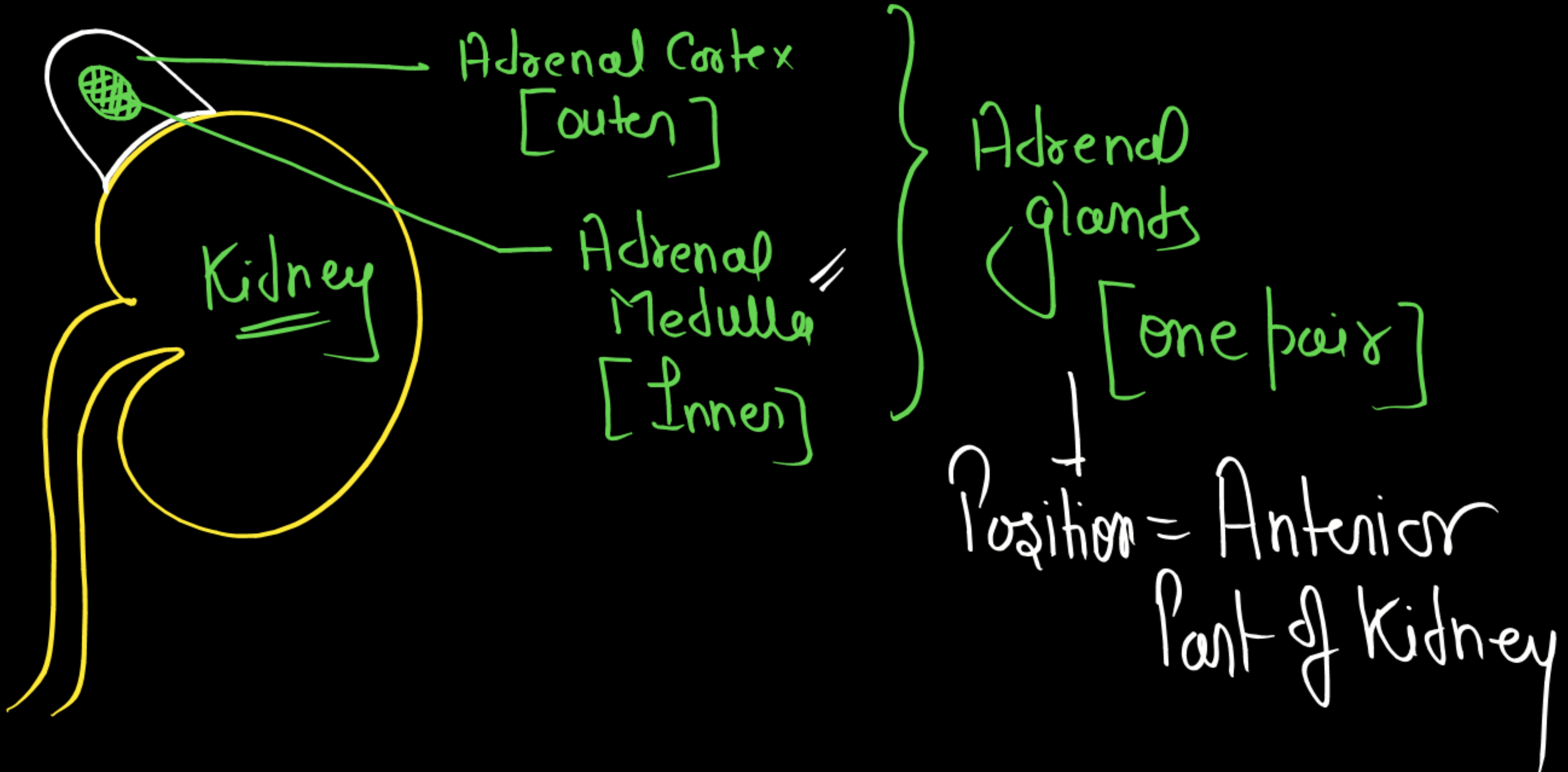
Polyphagia $\rightarrow$ Incomplete Breakdown of Fat $\rightarrow$ Formation of Ketone bodies

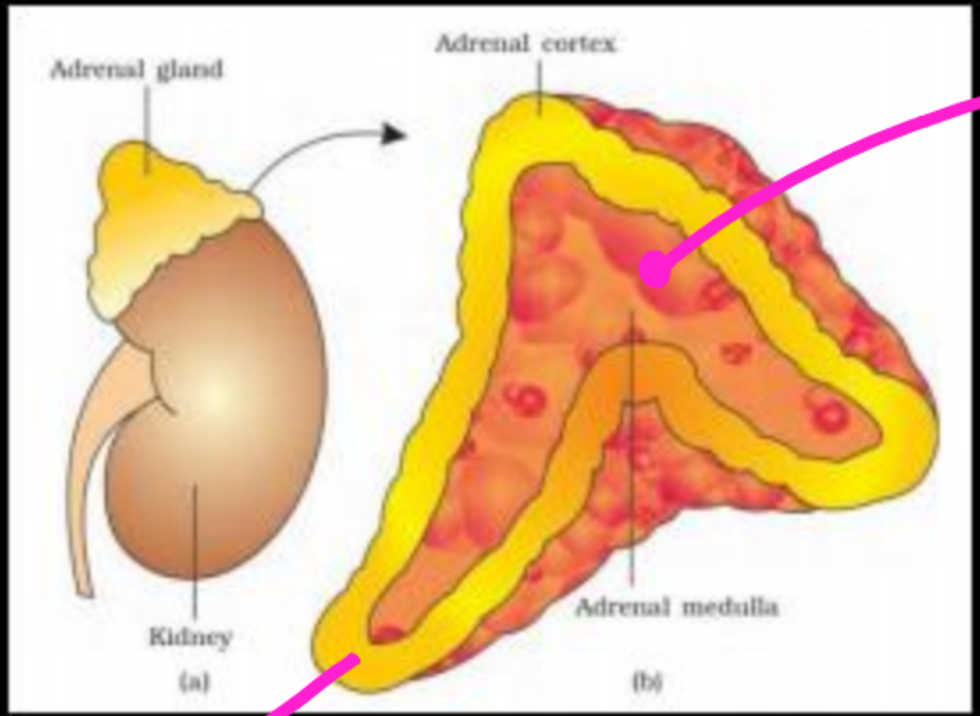
$\Downarrow$

(Ketonurea)

ADRENAL GLAND

- Our body has one pair of adrenal glands, one at the anterior part of each kidney.
- The gland is composed of two types of tissues. The centrally located tissue is called the adrenal medulla, and outside this lies the adrenal cortex.





Adrenal Medulla

- Origin = Ectodermal
- Nature of Hormones = Protein
- Medullary Hormones = F.F. Hormones or Emergency Hormo. or Catecholamines.

Adrenalin or Epinephrin [80%]

Nor-adrenalin or Nor Epinephrin [20%]

Function ⇒ ↑-alertness,
- ↑-Piloerection, Pupillary dilation
- Sweating =↑, Rate of Breathing & Heart Rate =↑
- ↑-Breakdown of Fat, Protein & Carbo.
- ↑-Blood Glucose level. etc.

Adrenal Cortex

Origin → Mesodermal

Nature of Hormone → Steroids [Fat Solu.]

Adrenal Cortex → *

In the given diagram of adrenal gland, the portion Y secretes

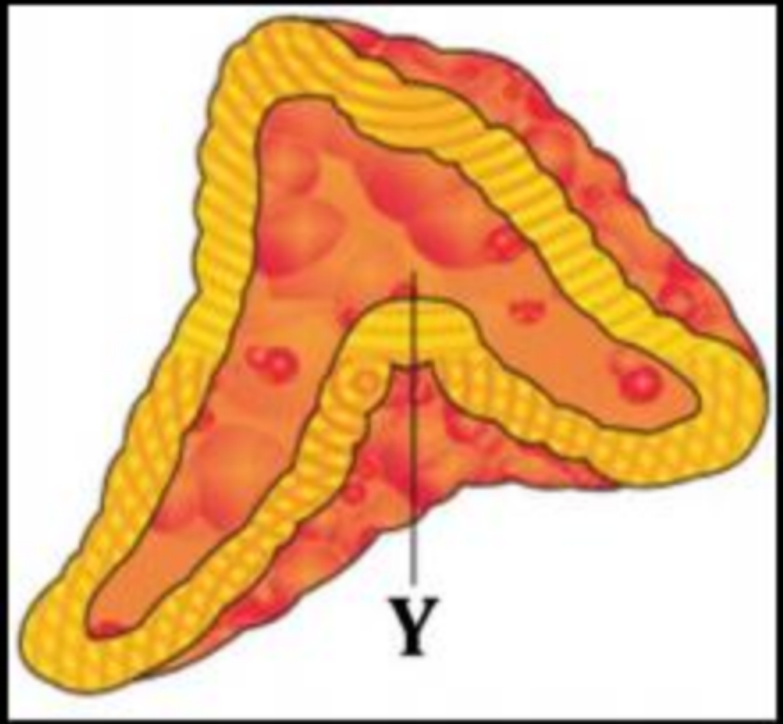
a. Epinephrine

b. Noradrenaline

c. Catecholamines

d. Aldosterone

e. Cortisol



(A) **a and b**

(B) **a, b and c**

(C) **a, b, c, d, e**

(D) **d and e**

Mark the mismatch

	Column I	Column II
(A)	Adrenaline	Prepares for emergency
(B)	Cortisone	General resistance to long term stress
(C)	Calcitonin	Calcium homeostasis
(D)	Prolactin releasing hormone	Acts on mammary glands

If a person is suffering from inflammatory disease such as arthritis, injection of which hormone can give some relief to patient?

(1) Glucocorticoid

(2) Adrenaline

(3) Parathormone

(4) Thyroxine

Match the following w.r.t. hormone and their function.

	Column I		Column II
a.	Oxytocin	(i)	Haemopoiesis
b.	Melatonin	(ii)	Milk ejection
c.	Cortisol	(iii)	Hypocalcemic hormone
d.	Thyrocalcitonin	(iv)	Circadian rhythm
		(v)	Hypercalcemic hormone

. Mark the mismatch.

	Column I	Column II
(1)	Adrenaline	– Prepares for emergency
(2)	Cortisone	– General resistance to long term stress
(3)	Calcitonin	– Calcium homeostasis
(4)	Prolactin releasing hormone	– Acts on mammary glands

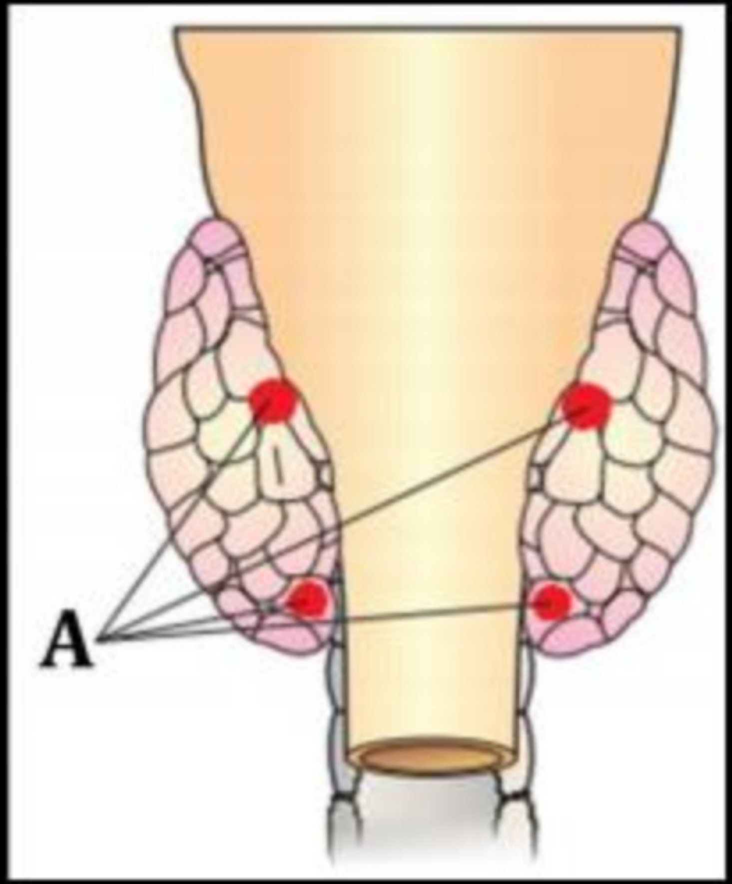
Following is a diagrammatic view of the position of the gland marked as 'A'. Choose the option which is correct identification of 'A', along with its function.

(A) Parafollicular cell of thyroid gland, secretes TCT which decrease blood calcium level

(B) Parathyroid gland secretes PTH, which increases blood calcium level

(C) Thyroid gland secretes thyroxine which is calorigenic hormone

(D) Parathyroid gland secretes PTH which regulates metamorphosis of frog



Which one of the following pairs incorrectly matches a hormone with a disease resulting from its deficiency?

	Hormones	Deficiency disorders
(A)	Somatotropin	Dwarfism
(B)	Thyroxine	Cretinism
(C)	Parathyroid hormone	Tetany
(D)	Insulin	Diabetes insipidus

Which hormone is synthesised by neurohypophysis?

(1) Oxytocin
(2) Vasopressin
(3) Prolactin
(4) None of these

Hormones show following features, **except**

(1) Non-nutritive

(2) Intercellular messengers

(3) Produced in trace amounts

(4) Always controlled via negative feedback loops

When a young child's body temperature drops, hypothalamus produces ____________ hormone.

(1) GH

(2) TSH

(3) TRH

(4) Somatocrinin

Which of the following disease is associated with symptoms like

I. Neonatal jaundice

II. Abnormal skin, deaf-mutism

III. Protruded tongue

IV. Low IQ

(1) Tetany

(2) Cretinism

(3) Exopthalmic goitre

(4) Myxoedema

THANK YOU !!

MANTHAN NEET 1.0 & 2.0

CHEMICAL COORDINATION AND INTEGRATION

LECTURE - 4

ZOOLOGY



MD SIR

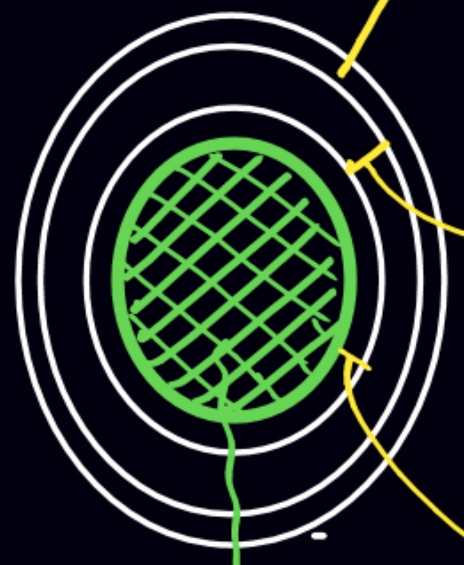
❑ TODAY'S GOAL -

- ❑ Adrenal Cortex ✓
- ❑ Gonads ✓
- ❑ Action Mechanism of Hormone ✓

ADRENAL GLAND

- Our body has one pair of adrenal glands, one at the anterior part of each kidney.
- The gland is composed of two types of tissues. The centrally located tissue is called the adrenal medulla, and outside this lies the adrenal cortex.

Adrenal Cortex →



Zona Glomarulosa (Outer layer)

Zona Fasciculata (Middle layer) = **Widest** layer

Zona Reticularis (Inner layer)

[Adrenal Medulla]

1)- Zona Glomerulosa →

- Group of Hormone = Mineralocorticoids
- Main Hormone = Aldosteron
- Secretion Control by = R.A.A.S.
- Function of Main Hormone = if Secretion of Aldosteron = ↑ = ↑ absorption of Na^+ & H_2O from D.C.T. + ↓ K^+ & PO_4^{-3} in Blood.
  - * Water-ionic Balance.
  - * Maintain = Osmolarity & Blood Pressure

2)- Zona Fasciculata (Widest layer)

- Group of Hormone = Glucocorticoids.
- Main Hormone = Cortisol, (Hydroxy cortisone) = Life Saving Hormone.
- Secretion Control by = A.C.T.H.
- Function of Main Hormone = Stimulate Erythropoiesis = Formation of R.B.C.
  = Act as antistress Hormone.
  - ↑ - Blood Glucose level → ↑ - Breakdown of Fat, Protein & Carbohydrate.
  - ↓ - Cellular uptake of A.A. & Glucose etc.
  = Act as = Immuno Suppressor →

used in →

- Allergy (as anti-allergic)
- Autoimmunity.
- Inflammation
- Organ transplantation.

(3) - Zona Reticularis (Inner layer) :⟶

Group of Hormones = Sex Corticoids

- Male Sex Hormones [Androgen] = D.H.E.A.
  - Function →
    - Body Hair
    - Facial Hair
    - Pubic Hair

    } Growth
- Female Sex Hormone [Estradiol] E

Disorders

Hypersecretion

1)- Cushing Syndrom
- ↑- Glucocorticoid.

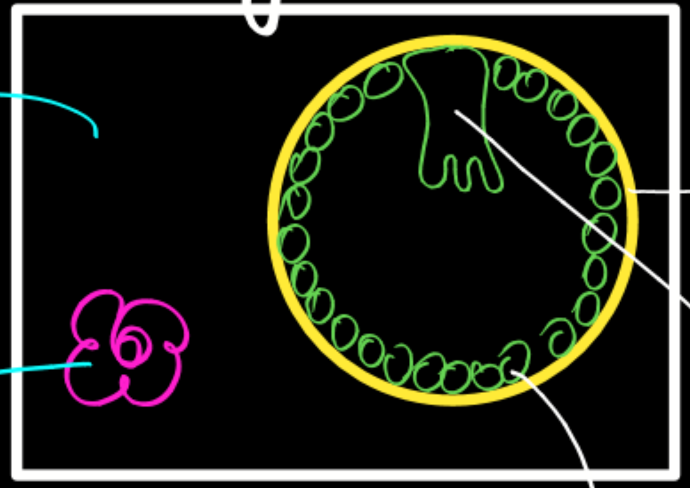
2)- Coon's diseases.
- ↑ = Mineralocorticoid.

vvvImp Hyposecretion NCERT

Addison's Diseases
- ↓- Mineralocorti
- ↓- Glucocortico

TESTIS

T.S. of Testis



Interstitial Space

Seminiferous Tubules

L.H → Interstitial cells or Leydig Cells

↓

Androgen [Testosteron]

→ Anabolic Eff.

→ Sec. Sexual Chara. & " " Organs.

Spermatogonia —(spermatogenesis)→ Spermatids → Sperms

F.S.H. → Sertoli Cells

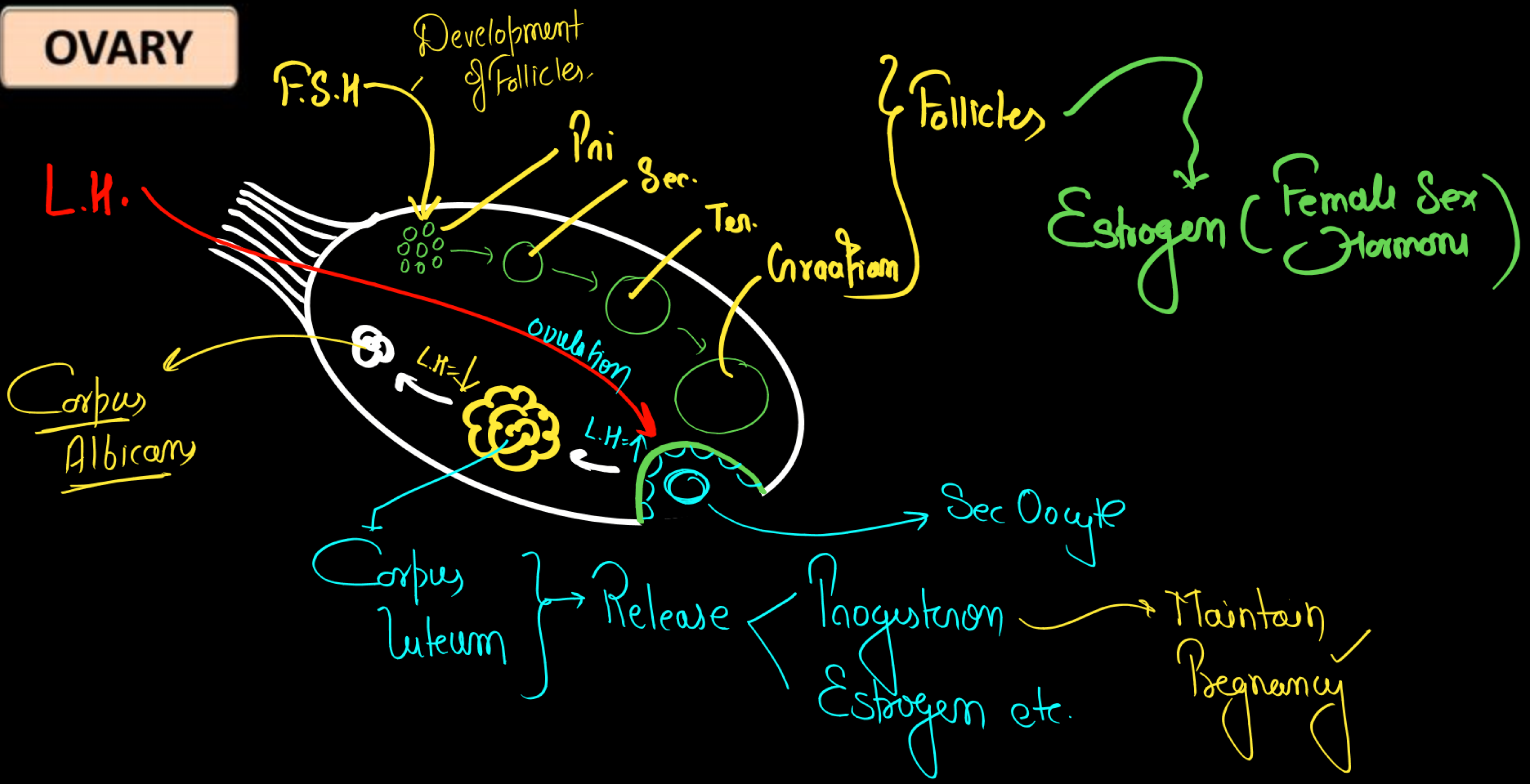
↓

Sperm maturation Factors → (Spermatids → Sperms)

Function of Androgens

- Androgens regulate the development, maturation and functions of the male accessory sex organs like epididymis, vas deferens, seminal vesicles, prostate gland, urethra etc.
- These hormones stimulate muscular growth, growth of facial and axillary hair, aggressiveness, low pitch of voice etc.
- Androgens play a major stimulatory role in the process of spermatogenesis (formation of spermatozoa).
- Androgens act on the central neural system and influence the male sexual behaviour (libido).
- These hormones produce anabolic (synthetic) effects on protein and carbohydrate metabolism.

OVARY



F.S.H
Development of Follicles
Pri
Sec.
Ter.
Graafian
Follicles
Estrogen (Female Sex Hormone)
L.H.
Ovulation
L.H=↓
L.H=↑
Corpus Albicans
Sec Oocyte
Corpus Luteum
Release
Progesterone
Estrogen etc.
Maintain Pregnancy

Function estrogens –

- Estrogens produce wide ranging actions such as stimulation of growth and activities of female secondary sex organs, development of growing ovarian follicles, appearance of female secondary sex characters (e.g., high pitch of voice, etc.), mammary gland development.
- Estrogens also regulate female sexual behaviour.
- Progesterone supports pregnancy. Progesterone also acts on the mammary glands and stimulates the formation of alveoli (sac-like structures which store milk) and milk secretion

22.3 Hormones of Heart, Kidney and Gastrointestinal Tract

Now you know about the endocrine glands and their hormones. However, as mentioned earlier, hormones are also secreted by some tissues which are not endocrine glands. For example, the atrial wall of our heart secretes a very important peptide hormone called **atrial natriuretic factor** (ANF), which decreases blood pressure. When blood pressure is increased, ANF is secreted which causes dilation of the blood vessels. This reduces the blood pressure.

The juxtaglomerular cells of kidney produce a peptide hormone called **erythropoietin** which stimulates erythropoiesis (formation of RBC).

Endocrine cells present in different parts of the gastro-intestinal tract secrete four major peptide hormones, namely **gastrin**, **secretin**, **cholecystokinin** (CCK) and **gastric inhibitory peptide** (GIP). Gastrin acts on the gastric glands and stimulates the secretion of hydrochloric acid and pepsinogen. Secretin acts on the exocrine pancreas and stimulates secretion of water and bicarbonate ions. CCK acts on both pancreas and gall bladder and stimulates the secretion of pancreatic enzymes and bile juice, respectively. GIP inhibits gastric secretion and motility. Several other non-endocrine tissues secrete hormones called **growth factors**. These factors are essential for the normal growth of tissues and their repairing/regeneration.

> G.I.P. = Inhibit — Gastric Motility; HCl Secretion
>
> Secretin → Stimulate (also Inhibit) — Secretion of Alkalin fluid from → Liver, Pancreas
>
> Gastrin → ↑ Secretion of Gastric juice.
>
> C.C.K → Stimulate — Bile juice, Pancreatic juice.

On the basis of their chemical nature, hormones can be divided into groups :

(i) **peptide, polypeptide, protein hormones** (e.g., insulin, glucagon, pituitary hormones, hypothalamic hormones, etc.)

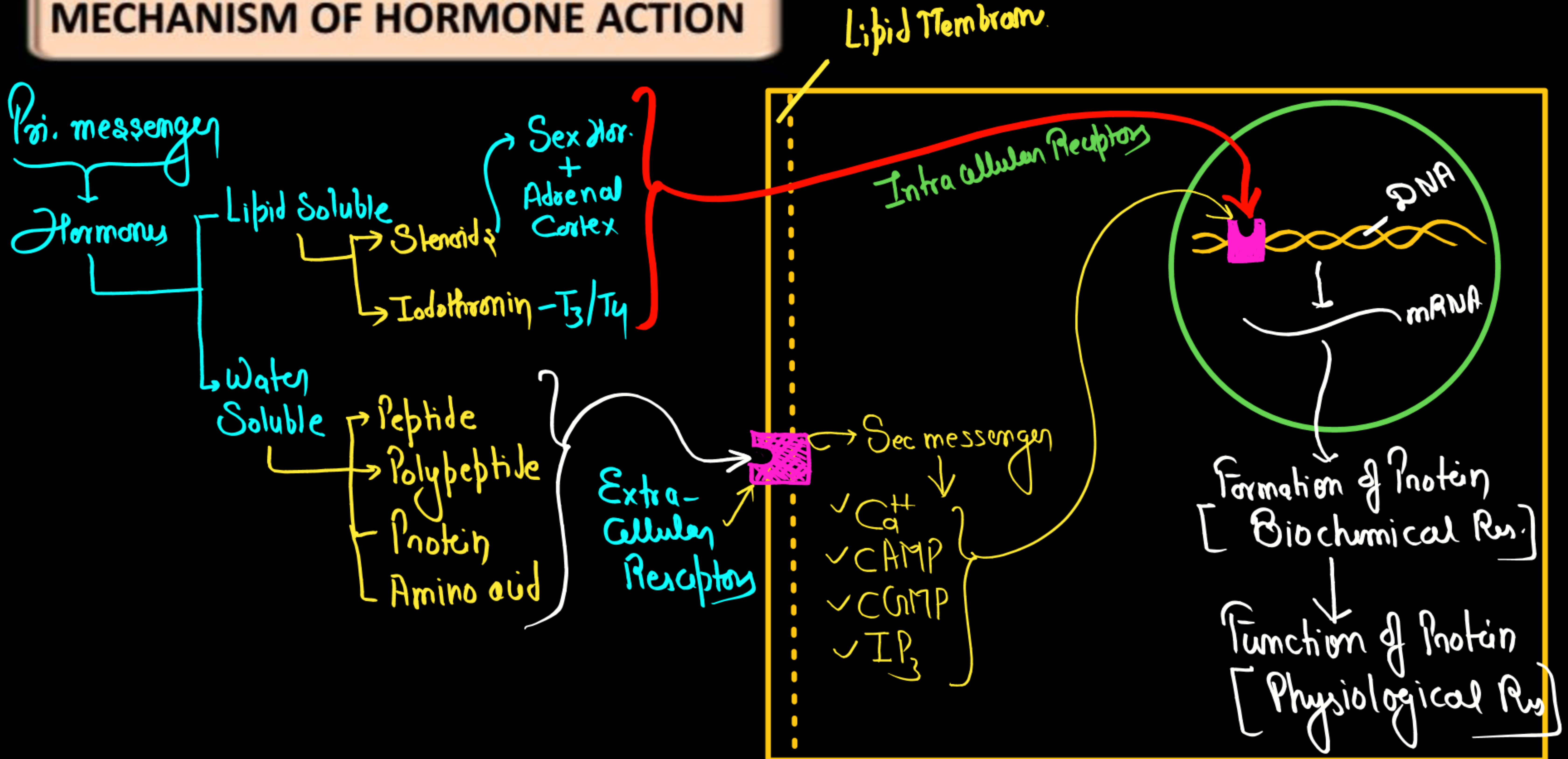
(ii) **steroids** (e.g., cortisol, testosterone, estradiol and progesterone)

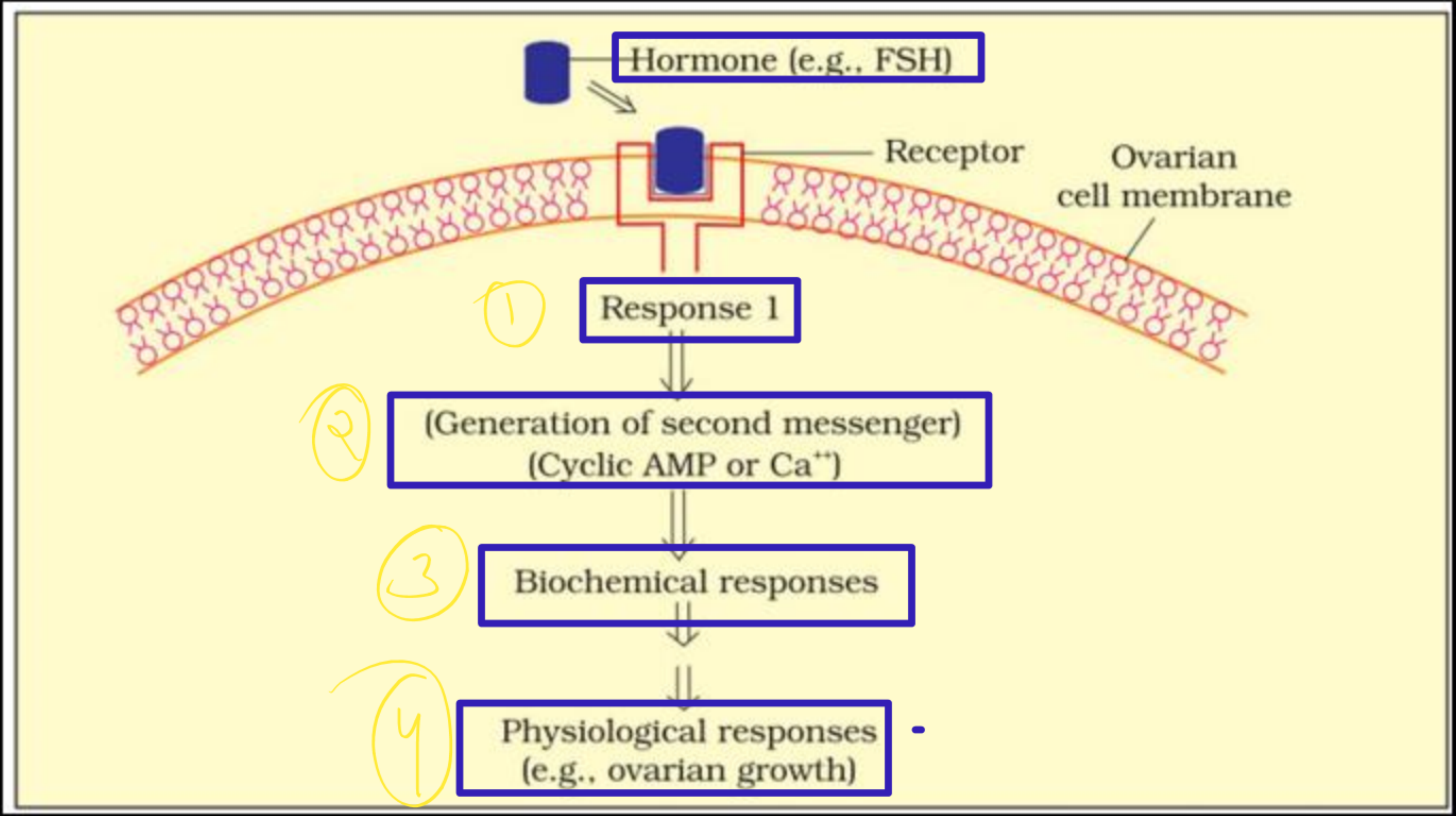
(iii) **iodothyronines** (thyroid hormones)

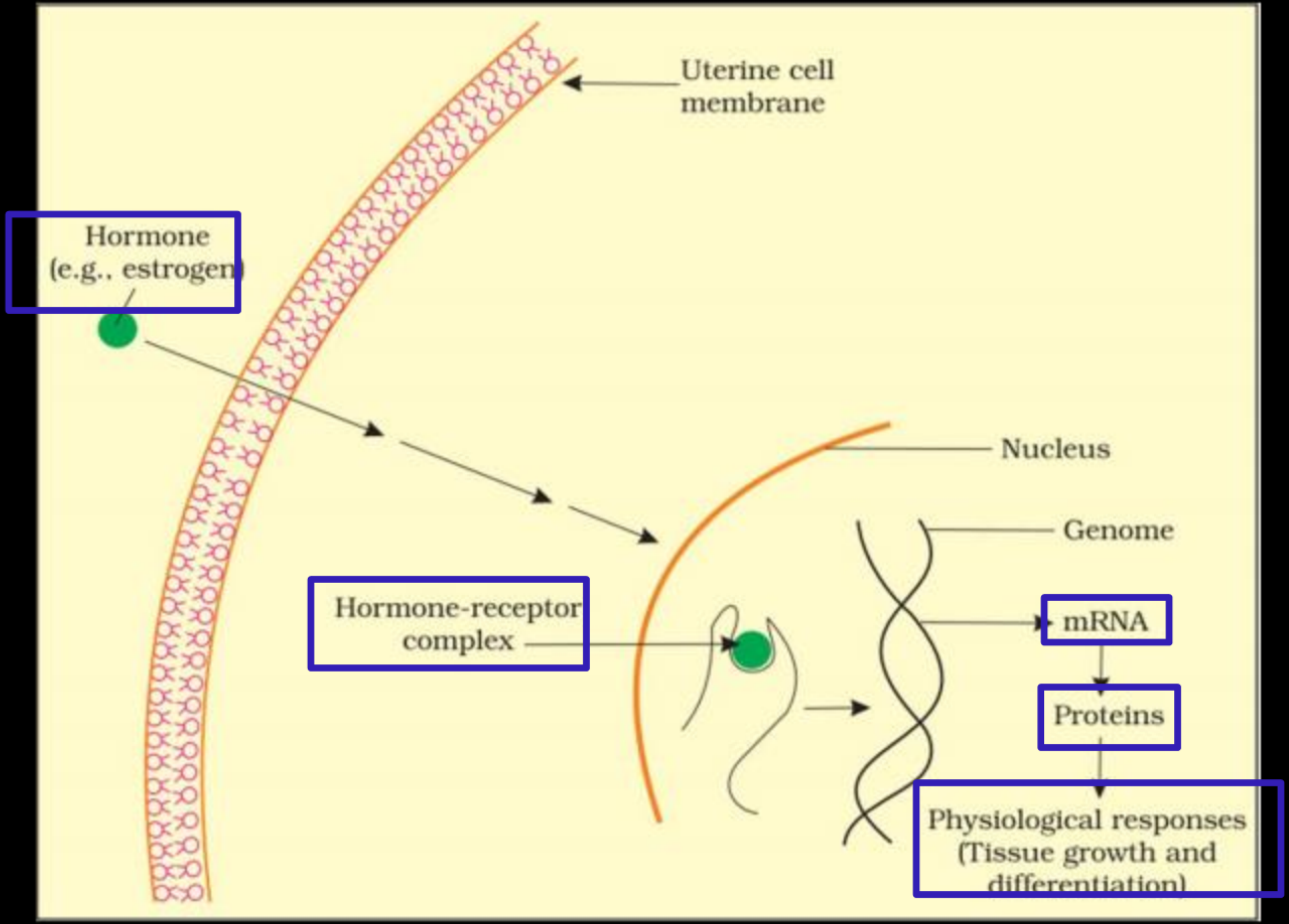
(iv) **amino-acid derivatives** (e.g., epinephrine).

Lipid Soluble

MECHANISM OF HORMONE ACTION




Hormone (e.g., FSH)
Receptor
Ovarian
cell membrane
Response 1
(Generation of second messenger)
(Cyclic AMP or Ca⁺⁺)
Biochemical responses
Physiological responses
(e.g., ovarian growth)


Uterine cell membrane
Hormone (e.g., estrogen)
Nucleus
Genome
mRNA
Hormone-receptor complex
Proteins
Physiological responses (Tissue growth and differentiation)

1. Correctly match column – I with column – II and find out the **correct** option:

Column-I		Column-II	
A.	Milk ejecting hormone	(i)	Cortisol
B.	Emergency hormone	(ii)	Epinephrine
C.	Milk synthesis hormone	(iii)	Prolactin
D.	Life saving hormone	(iv)	Oxytocin
E.	Metabolic hormone	(v)	Thyroxine

(A) A $\rightarrow$ (i), B $\rightarrow$ (ii), C $\rightarrow$ (iii), D $\rightarrow$ (iv), E $\rightarrow$ (v)
(B) A $\rightarrow$ (iv), B $\rightarrow$ (ii), C $\rightarrow$ (iii), D $\rightarrow$ (v), E $\rightarrow$ (i)
(C) A $\rightarrow$ (iii), B $\rightarrow$ (ii), C $\rightarrow$ (iv), D $\rightarrow$ (i), E $\rightarrow$ (v)
(D) A $\rightarrow$ (iv), B $\rightarrow$ (ii), C $\rightarrow$ (iii), D $\rightarrow$ (i), E $\rightarrow$ (v)

2. Pick up the odd one in each series and select **correct** option:

(1) Melatonin, Gonadotrophins, ACTH, Oxytocin

(2) T3, T4, TCT, PTH

(3) Cortisol, Estrogen, FSH, Thyroxine

(4) Gastrin, ANF, Secretin, CCK

	1	2	3	4
(A)	Gonadotrophins	TCT	FSH	CCK
(B)	Melatonin	PTH	FSH	ANF
(C)	Melatonin	TCT	Thyroxine	ANF
(D)	Oxytocin	PTH	Estrogen	CCK

5. Match the following:

Column-I		Column-II	
(a)	T_4	(i)	Hypothalamus
(b)	PTH	(ii)	Thyroid
(c)	GnRH	(iii)	Pituitary
(d)	LH	(iv)	Parathyroid

Which of the following is correct?

(A) a = i, b = ii, c = iii, d = iv
(B) a = ii, b = iv, c = i, d = iii
(C) a = ii, b = iv, c = iii, d = i
(D) a = iv, b = ii, c = i, d = iii

6. Aldosterone is secreted by:

(A) Zona glomerulosa
(B) Zona fasciculata
(C) Zona reticularis
(D) Zona pellucida

9. For which of the hormone, receptors are present in cytoplasm:

(A) FSH
(B) Adrenaline
(C) Aldosterone
(D) Prostaglandins

10. Both the thyroid and parathyroid glands secrete hormones that control the concentration of .... ions in the blood, the amount of this ion is decreased by .... and increased by ....:

(A) Ca^{2+}, thyrocalcitonin, paratharmone
(B) I^-, thyrocalcitonin, paratharmone
(C) I^-, paratharmone, thyrocalcitonin
(D) Ca^{2+}, paratharmone, thyrocalcitonin

50. Which one of the following is not a second messenger in hormone action?

(A) cGMP
(B) Calcium
(C) Sodium
(D) cAMP

48. Which of the following pairs of organs includes only the endocrine glands?

(A) Adrenal and Ovary
(B) Parathyroid and Adrenal
(C) Pancreas and Parathyroid
(D) Thymus and Testes

40. Luteinising hormone (LH) in female:

(A) Helps in the appearance of secondary sexual characters
(B) Stimulates ovary to secrete oestradiol
(C) Helps in release of the ovum from the ovary
(D) Controls the blood pressure

36. A hormone which maintains BMR, regulates the metabolism of proteins and erythropoiesis is:

(A) Adrenaline

(B) Thymine

(C) Thyroxine

(D) Thymosin

35. In females, LH stimulates _______ in the ovary to secrete _______.

(A) Graafian follicle, ICSH respectively
(B) Graafian follicle, prolactin respectively
(C) Corpus luteum, FSH respectively
(D) Corpus luteum, progesterone respectively

27. Which hormones stimulate muscular growth, growth of facial and axillary hair, low pitch of voice?

(A) Estrogen
(B) Androgens
(C) Glucocorticoids
(D) Prolactin

THANK YOU !!

MANTHAN NEET

ANIMAL KINGDOM

LECTURE - 1

ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

- ❑ Basis of classification ✓

Basic Features of all Animals

1) → Multicellular
+
2) - Eukaryotic
+
3) - Holozoic Mode of Nutrition

→ @ [Metazoa]

- [Parazoa] → Cellular level of Organisation
  - eg [Porifera - Sponges] ok
- Imp [Eumetazoa] → (Tissue, Organ, Organ System level of Organisation)
  - eg [Coelenterata to Mammalia]

(1) Levels of Organisation -

a) - Cellular level of Organisation → Porifera

b) - Tissue level of Organisation → Cnidaria & Ctenophora.

c) - Organ level of Organisation → Platyhelminthes

d) - Organ System level of Organisation → Aschelminthes to Chordata.

(2) Patterns of complexities



- [Digestive System]
  - [Incomplete]
    - Single opening act as → Mouth / Anus
    - eg → Cnidaria, Ctenophora, Some platyhelminthes
  - [Complete Dig.]
    - Both opening tnt Mouth & Anus
    - eg - Aschelminthes to Chordata.
- [Circulatory System]
  - [Open] – eg
    - ⊙ Annelida - leech
    - ⊙ Arthropoda.
    - ⊙ Mollusca Except - Cephalopoda
    - ⊙ - Echinodermata
    - ⊙ - Hemichordata.
  - [Closed Type]
    - ⊙ Annelida.
    - ⊙ Cephalopoda
    - ⊙ - Chordata.

All - Phylum →

1) - Porifera
2) - Cnidaria
3) - Ctenophora
4) - Platyhelminthes
5) - Aschelminthes
6) - Annelida
7) - Arthropoda
8) - Mollusca
9) - Echinodermata
10) - Hemichordata
11) - Chordata → Classes

(3) Symmetry - [Axis, Plane.]

- → Asymmetric Animals → Mostly Sponges eg Spongella (Fresh water Sponge)
- → Radial Symmetry → Some Sponges + Cnidaria + Ctenophora + Adult - Echinodermata.
- Bilateral Symmetry → Platyhelminthes to Chordata.

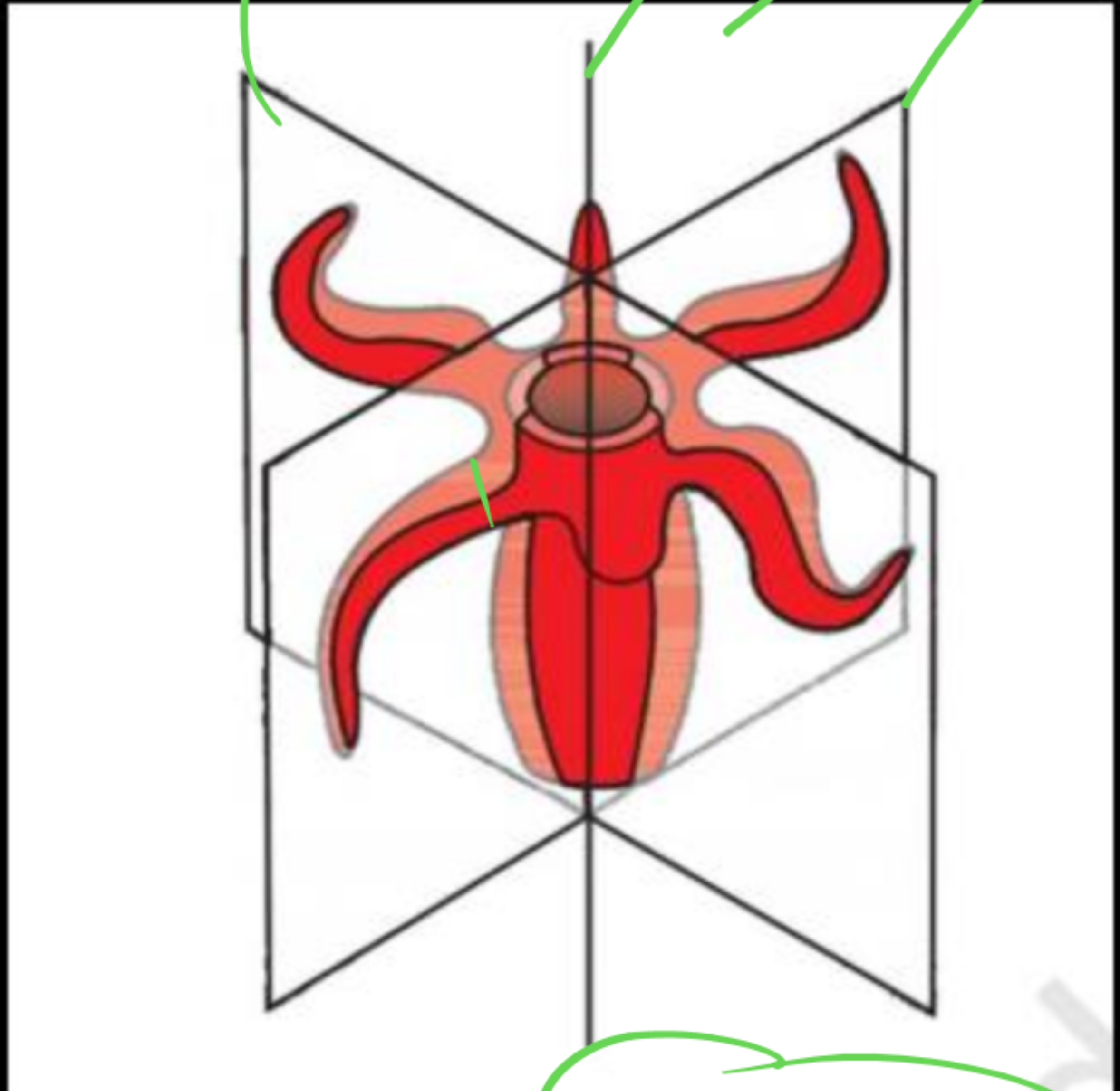


Figure 4.1 (a) Radial symmetry

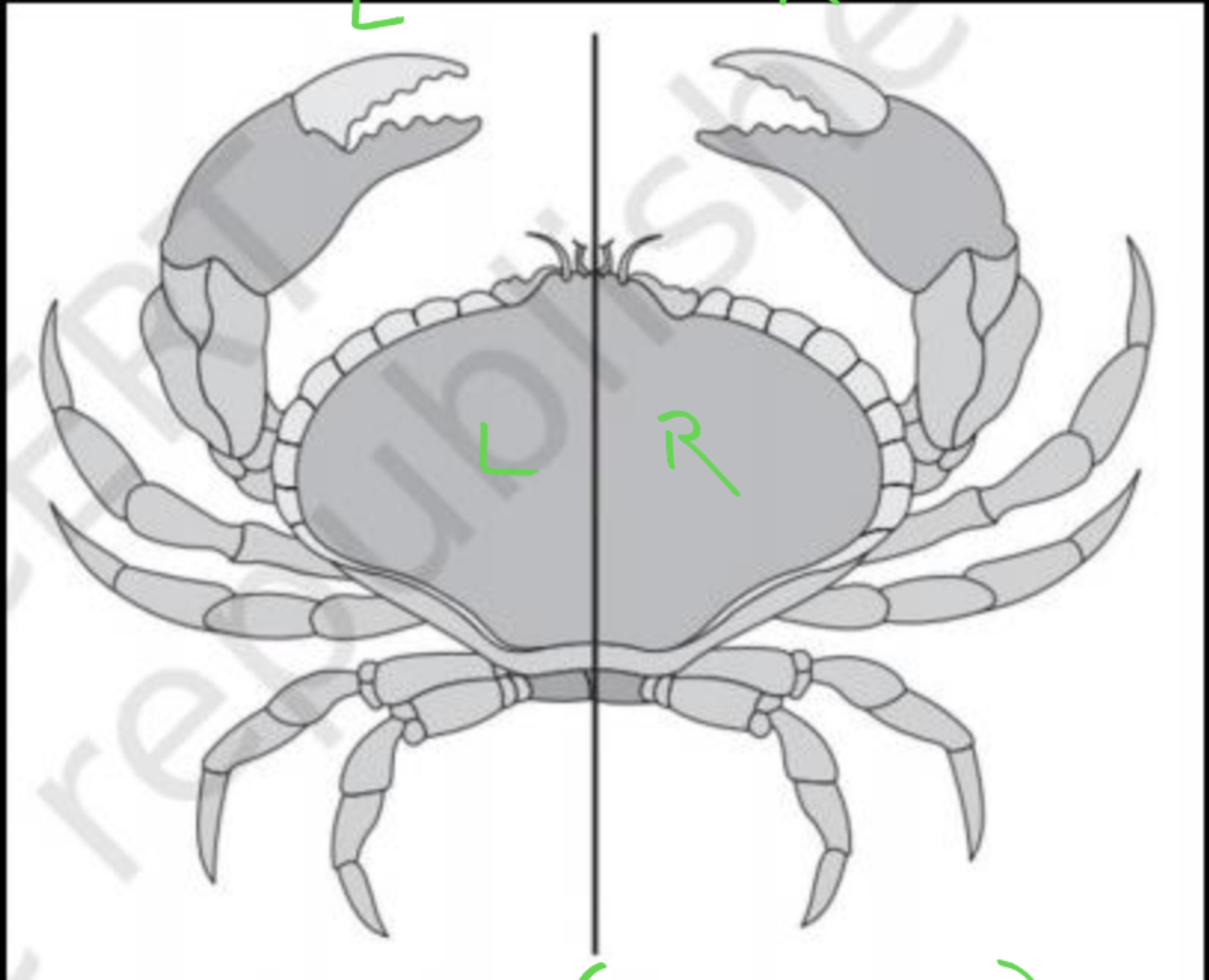


Figure 4.1 (b) Bilateral symmetry

(4) Diploblastic and Triploblastic Organisation (Germ Layers)

n + n ⇒ Zygote → Ectoderm, Mesoderm, Endoderm } Germ layer

[Germ layer]

- **[Diploblastic]** → Only Two germ layer → Ectoderm + Endoderm → eg. Cnidaria + Ctenophora.
- **[Triploblastic]** → 3-Germ layer → Ectoderm + Mesoderm + Endoderm → eg. Platyhelminthes to Chordata.

Cnidaria
+
Ctenophora

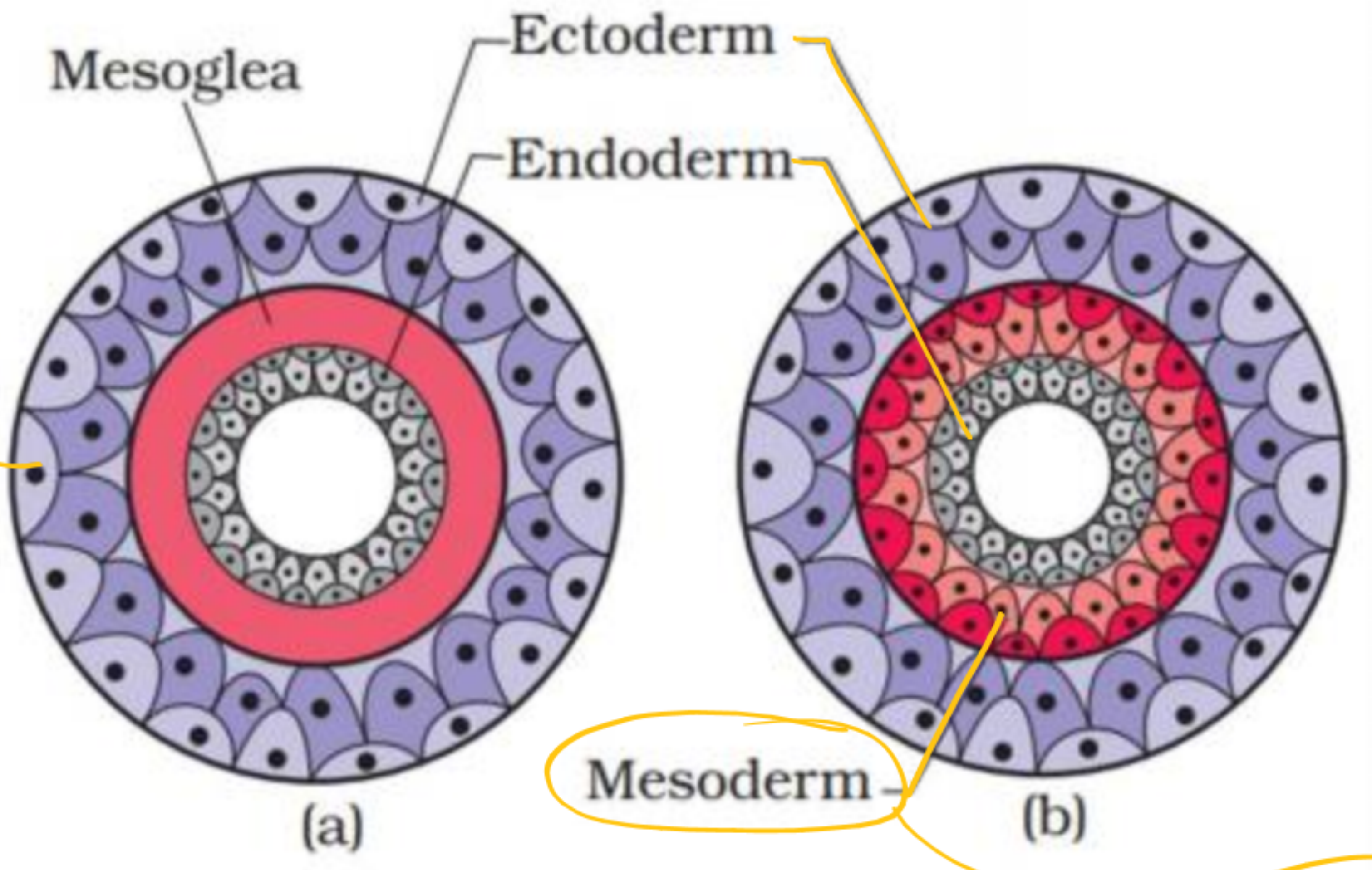


Figure 4.2 Showing germinal layers :
(a) Diploblastic (b) Triploblastic

Platyhelminthes to Chordata.

Ist time Originate in = Platyhelminthes.

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ANIMAL KINGDOM

LECTURE - 2

ZOOLOGY

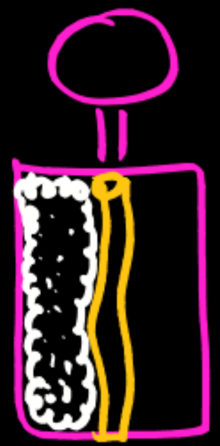


MD SIR

❑ TODAY'S GOAL -

- ❑ Basis of classification
- ❑ Phylum Porifera

(5) Coelom - Fluid fild Cavity, which Originate from - Mesoderm, +nt b/w → Outer - Body wall & inner gut wall

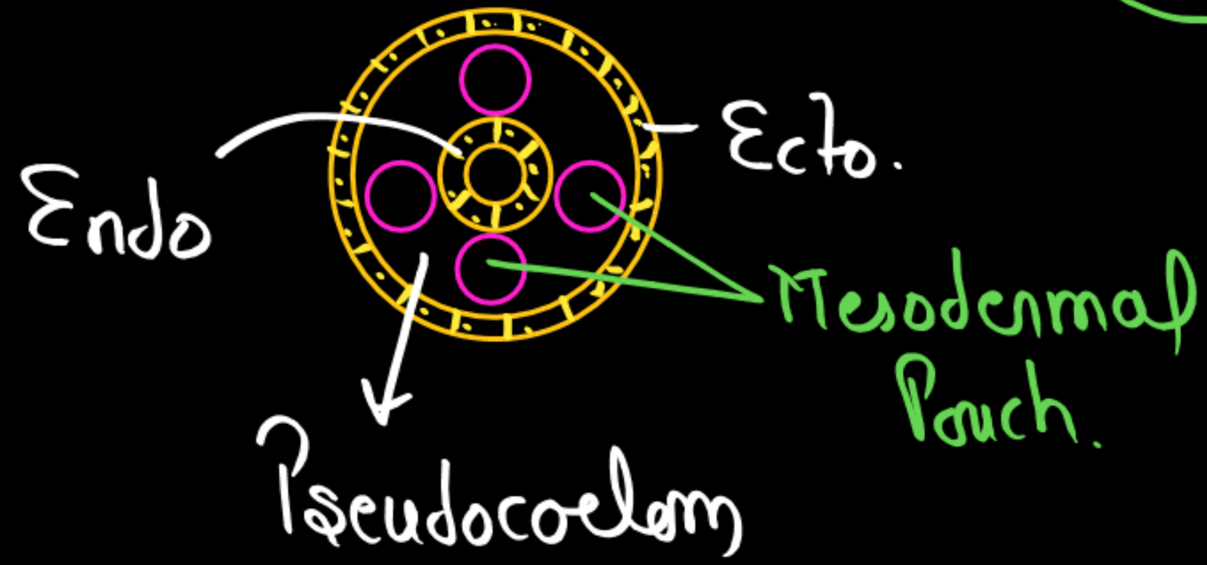


[Acoelomate]

- (Diploblastic Acoelomate)
  - eg → Cnidaria
  - → Ctenophora
- (Triploblastic Acoelomate)
  - eg → Platyhelminthes
  - → Solid Mesoderm

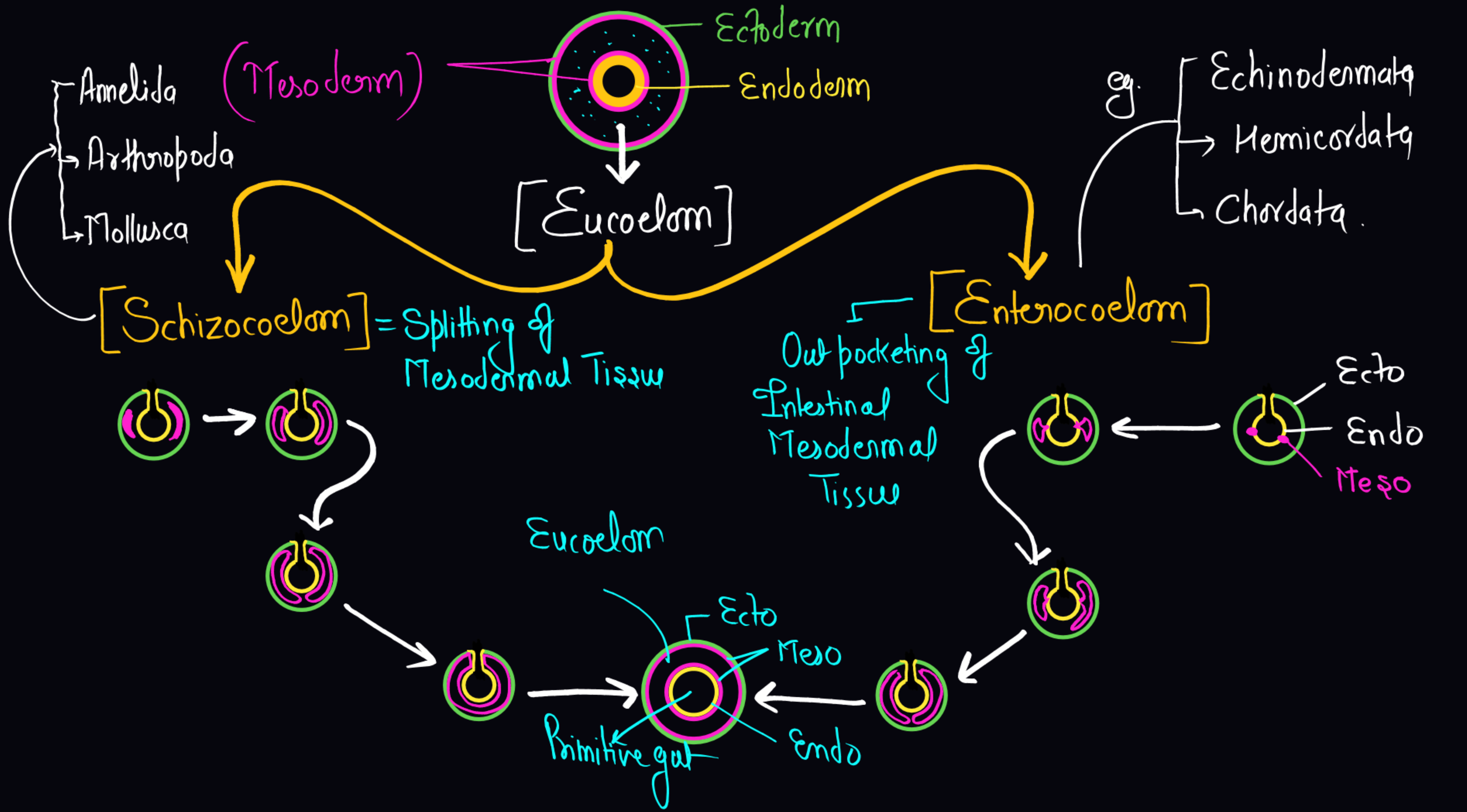


[Pseudocoelomate]



eg → Aschelminthes

[Eucoelomate]



Ectoderm
(Mesoderm)
Endoderm
Annelida
Arthropoda
Mollusca
eg.
Echinodermata
Hemicordata
Chordata.
[Eucoelom]
[Schizocoelom] = Splitting of Mesodermal Tissue
[Enterocoelom]
Out pocketing of Intestinal Mesodermal Tissue
Ecto
Endo
Meso
Eucoelom
Ecto
Meso
Endo
Primitive gut

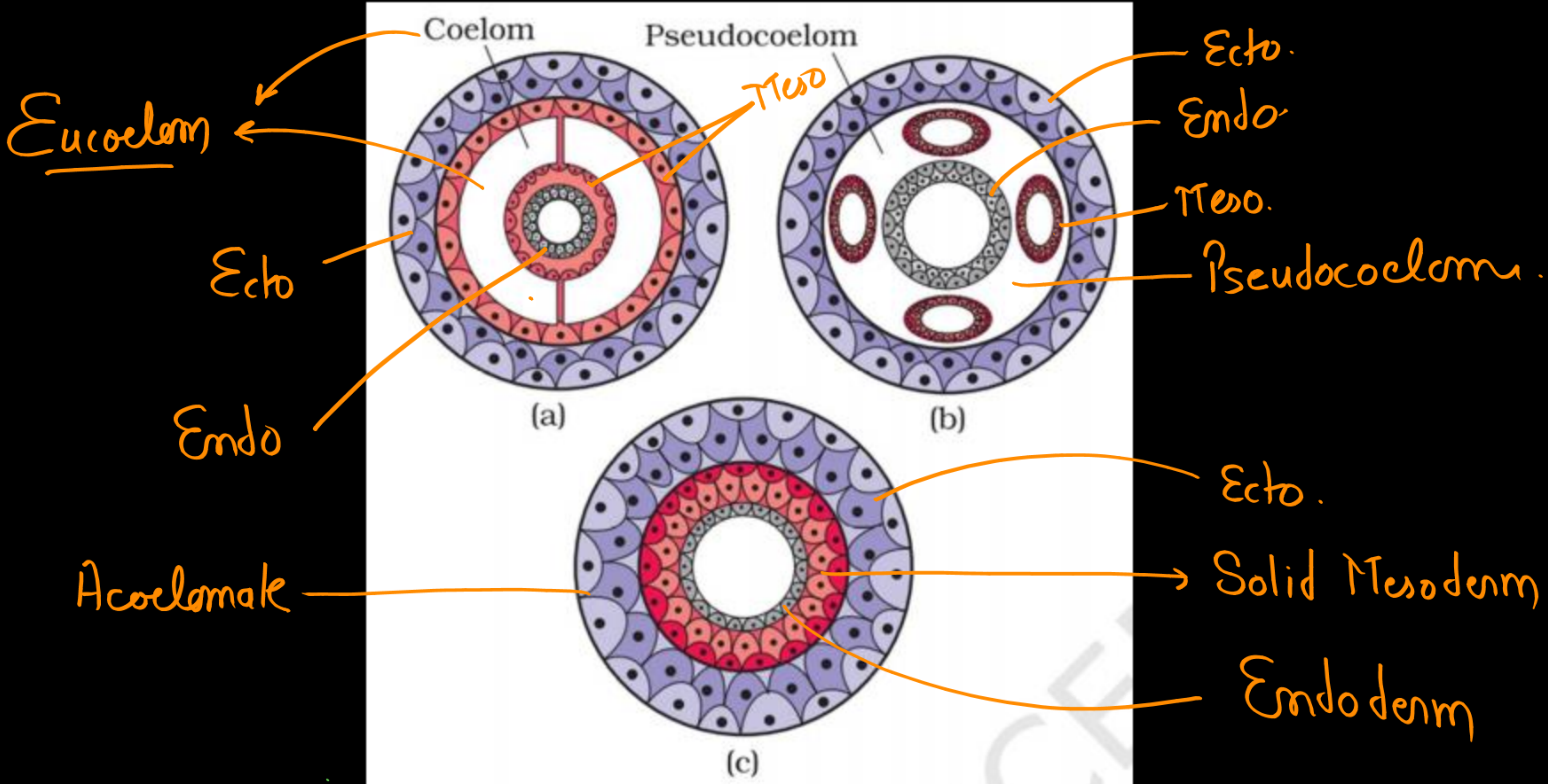


Figure 4.3 Diagrammatic sectional view of :
(a) Coelomate (b) Pseudocoelomate
(c) Acoelomate

(6) Body Plan -

1) - Cell Aggregation Type → Cellular level of Organisation eg - Porifera

2) - Blind Sac Type → [Incomplete Digestive Sys.]  → Cnidaria, Ctenophora, Platyhelminthes.

3) - Tube-Within Tube → [Complete Digestive Sys.] in [Eucoelomate]

1) - [Protostome]
- Ist Mouth
- Annelida, Arthropoda, Mollusca.

[Duetrostome]
- Ist - Convert into anus then - Mouth.
- Echinodermata, Hemichordata, Chordata.

Blastopore
- Convert into Mouth - Ist (Protostome)
- Ist - Convert into anus then - Mouth (Duetrostome)



(7) Segmentation -

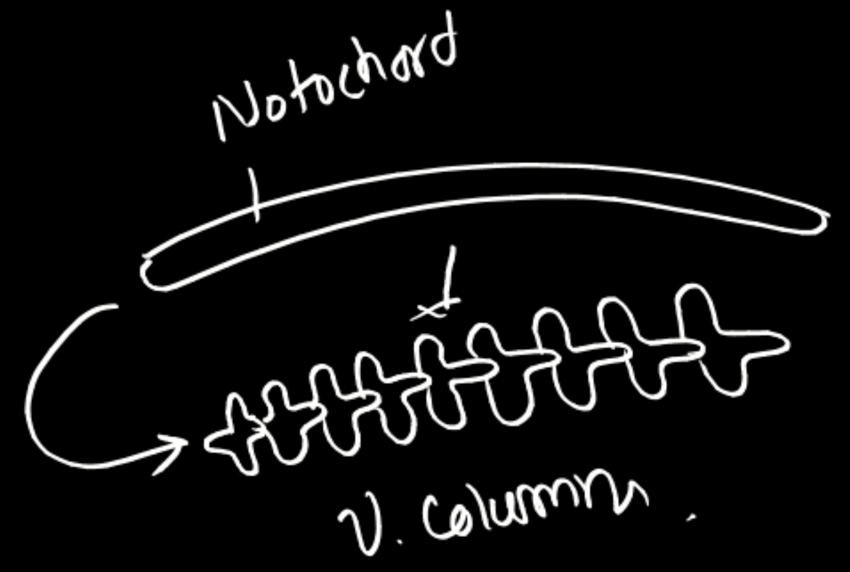
[Metamaric Segmentation]

(External Division Correspond to internal Division
or
Position of Internal Organs according to External Segmentation)

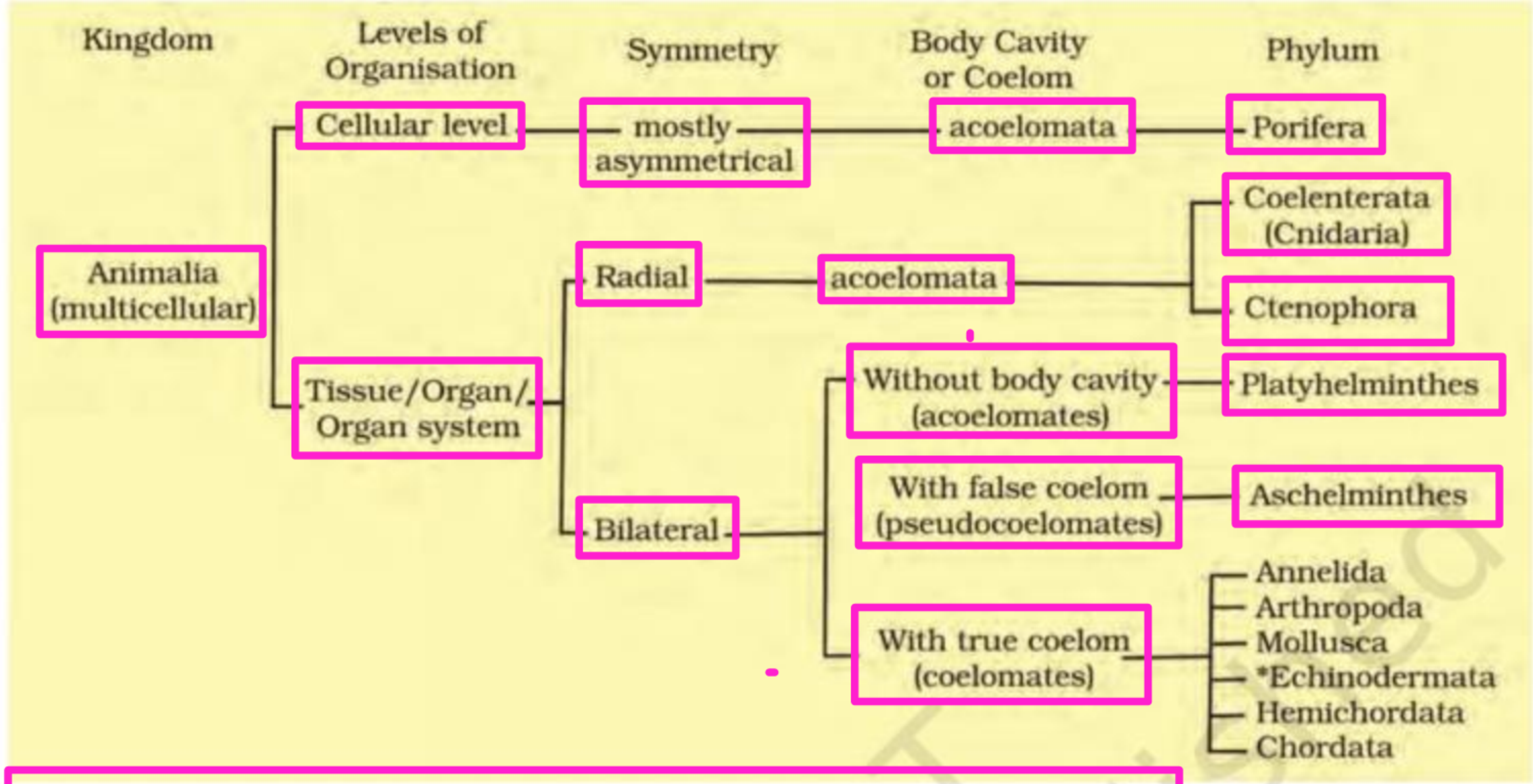
eg - Annelida + Arthropoda + Chordata



(8) Notochord -
- Rode like Structure
- Origin = Mesodermal (Endo skeleton)
- Pnt only in Chordata.
- In Some Chordates, Notochord Replaced by Vertebral Columns, Called = Vertebrata.



Note = All Chordata are not Vertebrata
= All Vertebrata are Chordata



*Echinodermata exhibits radial or bilateral symmetry depending on the stage.

H.W.

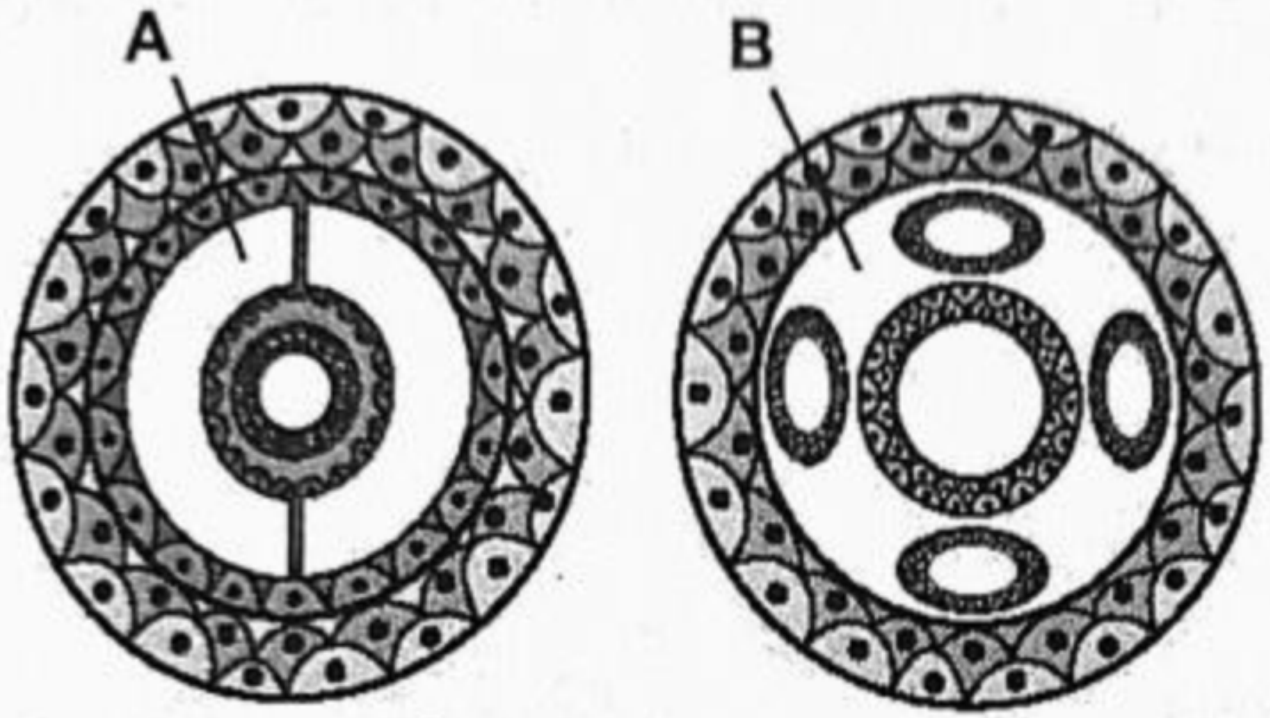
Consider following features:
(NEET-2019]
(a) Organ system level of organization
(b) Bilateral symmetry
(c) True coelomates with segmentation of body
Select the correct option of animal groups which possess all the above characteristics.

(1) Annelida, Arthropoda and Chordata
(2) Annelida, Arthropoda and Mollusca
(3) Arthropoda, Mollusca and Chordata
(4) Annelida, Mollusca and Chordata

Identify a pseudocoelmate animal :

(1) Planaria
(2) Starfish
(3) Ascaris
(4) Pleurobranchia.

A and B are two types of coeloms indicated in diagrams? A and B are found respectively in :



(1) Phylum arthorpoda and phylum platyhelminthes

(2) Phylum annelida and phylum aschelminthes

(3) Phylum mollusca and phylum plathyhelminthes

(4) Phylum annelida and phylum arthropoda.

THANK YOU !!

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ANIMAL KINGDOM

LECTURE - 3

ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

- ❑ Phylum Porifera ✓
- ❑ Phylum Coelenterate ✓
- ❑ Phylum Ctenophore ✓

Phylum – Porifera

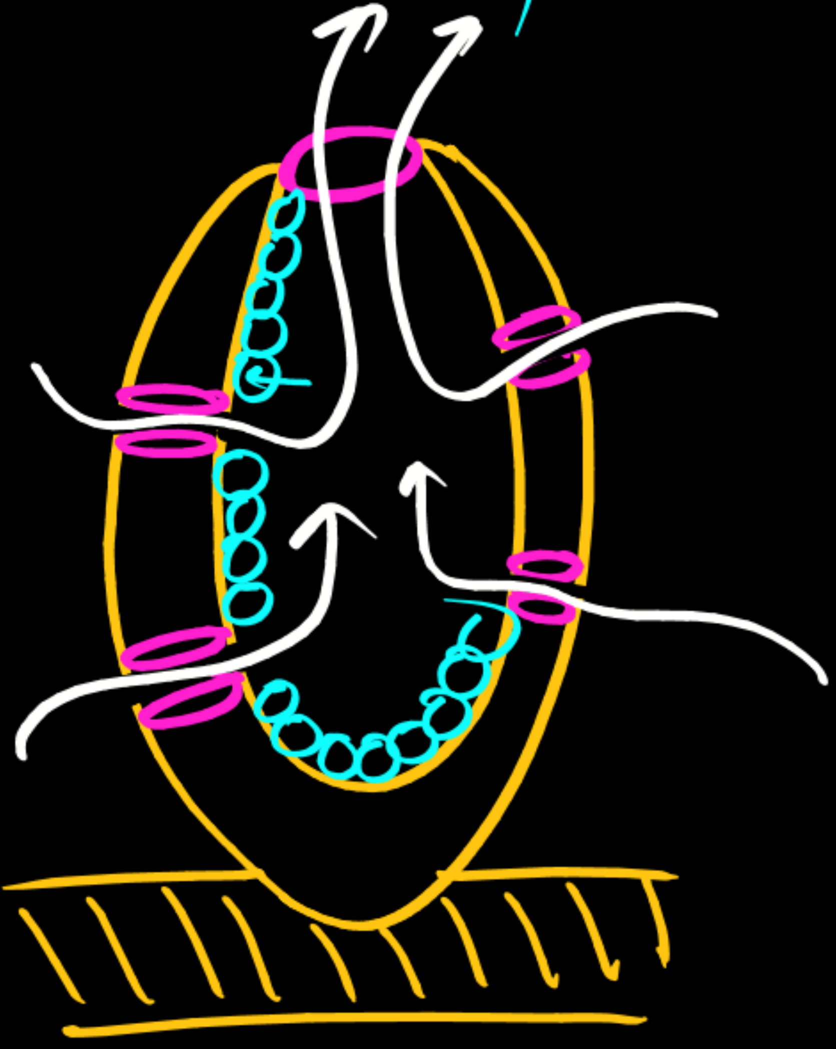
Pore   bearing

1) → Habitat = Mostly Marine, but Some are in fresh Water eg- Spongilla.

2) → Symmetry = Mostly = Asymmetrical (Spongilla)
Some = Radial Symm. (Scypha)

3) → Level of Organisation = Cellular level of Organisation
Division of Labour.

4) → Digestion. = Intra-Cellular Digestion [Digestion With in cell]
by - Choanocyte Cells [Collar cells]
are in Spongocoel [Cavity of Sponge]



5) → Body Cavity = Sponzocoel

6) → Respiration & Excretion → Body Surface.

7) → Skeleton +nt ⇒ Form by → Spicules (-nt in bath sponge or Euspongia.)
→ Spongin fibres

⑧ → Reproduction →

* Sexuality → H.M.B [♂ & ♀ gametes +nt in Same Organism or Sex are not Saperated]

NCERT (Hermaphrodite)

Monoecious

Bisexual

Types of Reproduction →



- [Asexual]
  - (Fragmentation)
  - (Budding)
    - (External) 
    - [Internal budding]

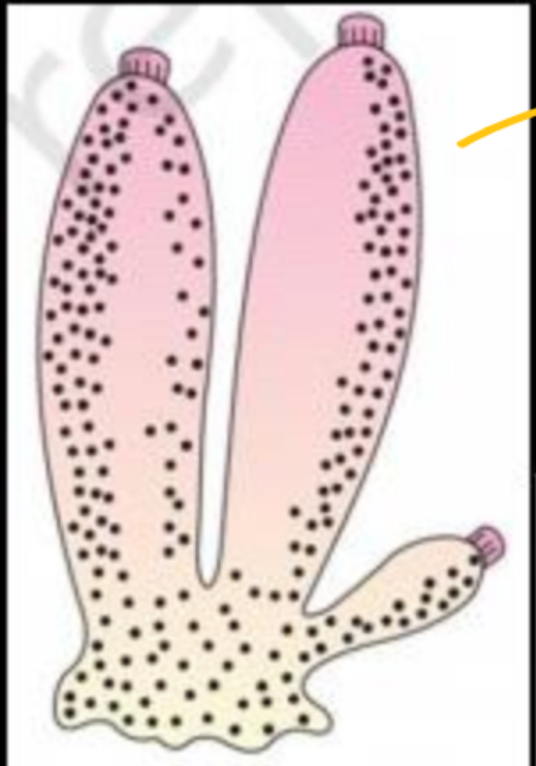


(Archiocyte cells)

Gemmule → tnt in fresh water sponge [Spongilla]

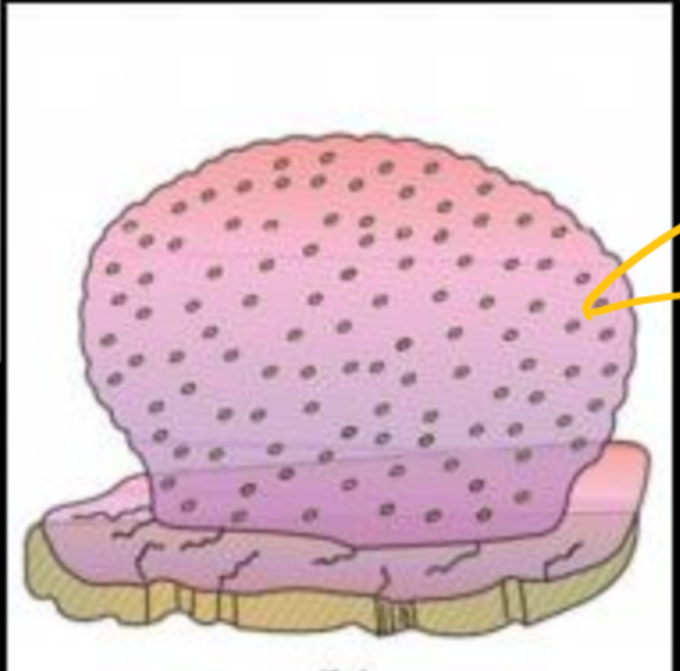
- [Sexual] = Formation of ♂ & ♀ Gametes.
  - Fertilization = Internal & Cross.

9)- Development = Indirect = Lanva tnt



(a)

Sycon (Scypha)

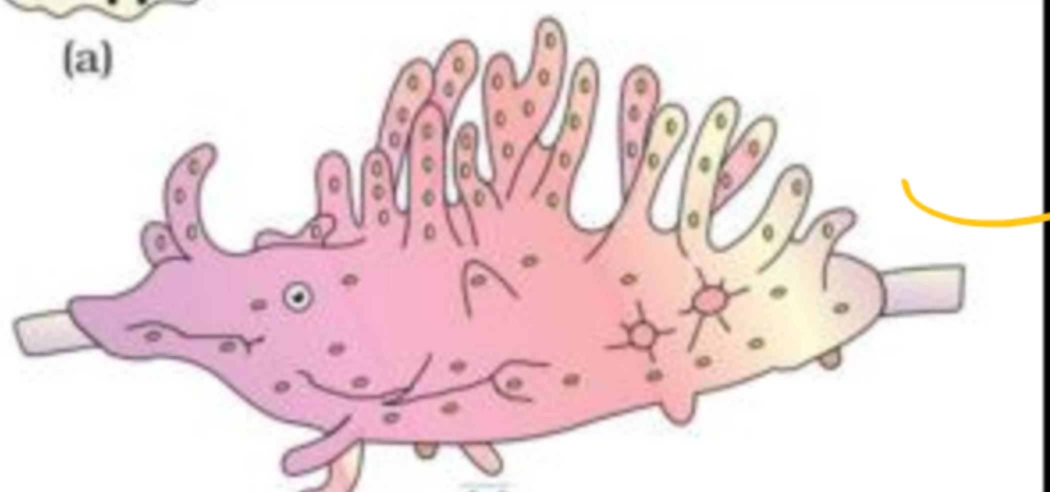


(b)

Euspongia (Bath sponge)

Spicules -nt

(a)



(c)

Spongilla (Fresh Water Sponges)

Symmetry = Asymm

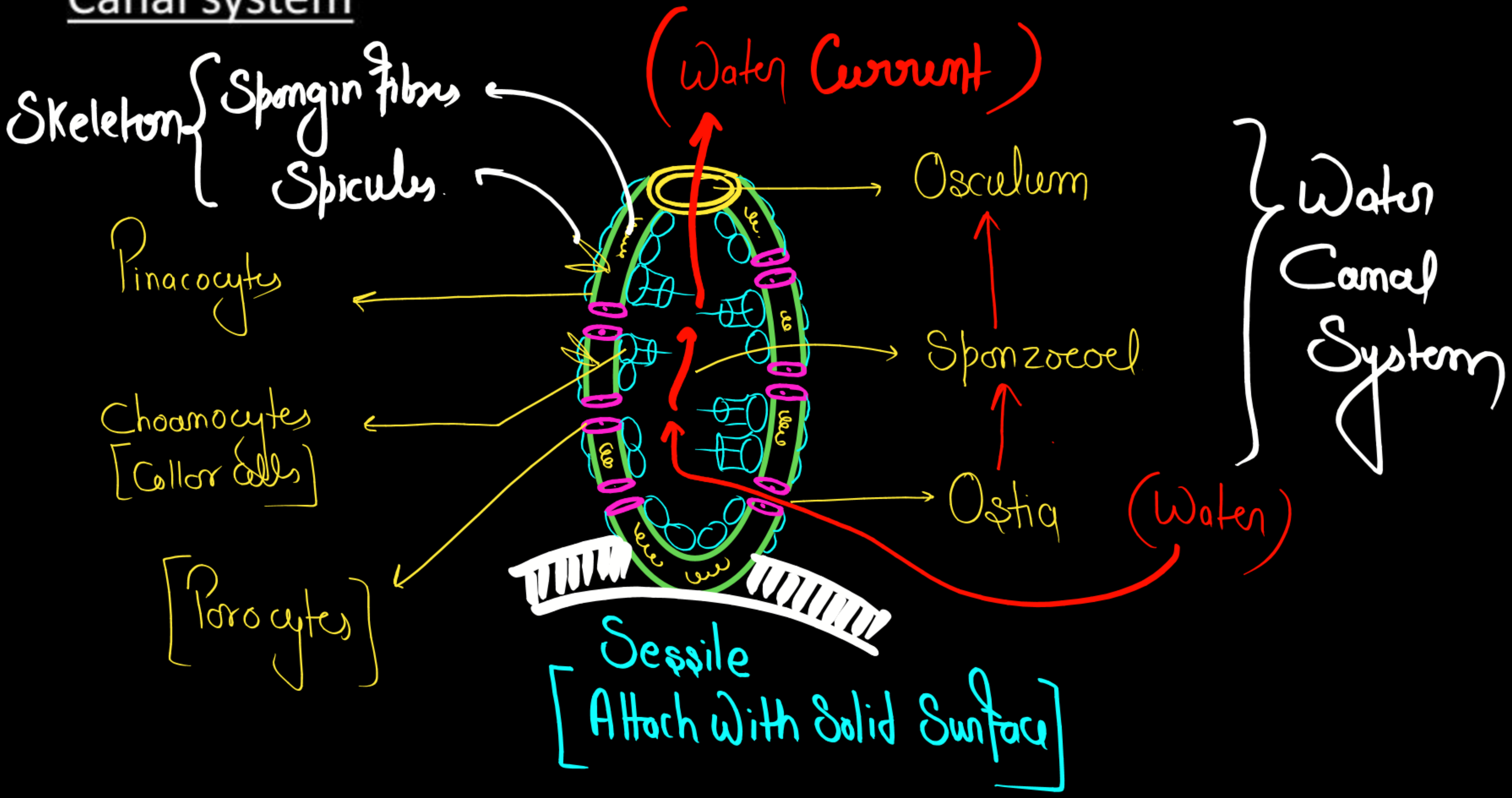
Gemmule +nt

Water Canal System →

Sponges have a water transport or canal system. Water enters through minute pores (ostia) in the body wall into a central cavity, spongocoel, from where it goes out through the osculum. This pathway of water transport is helpful in food gathering, respiratory exchange and removal of waste., Fertilization = Cross

Examples: Sycon (Scypha), Spongilla (Fresh water sponge) and Euspongia (Bath sponge).

Canal system



Phylum – Coelenterata (Cnidaria)

Gastro-Vascular Cavity / Coelenteron present — Cnidoblast present

1) - Habitate = Mostly = Marine, but Some present in fresh Water (Hydra)

= Cnidarians → Free Swimming / Sessile (attach with Solid Surface)

2) - Symmetry = Radial

3) - Level of Organisation = Tissue level of Organisation

4) → Germ layer = Diploblastic [Two-germ layer]

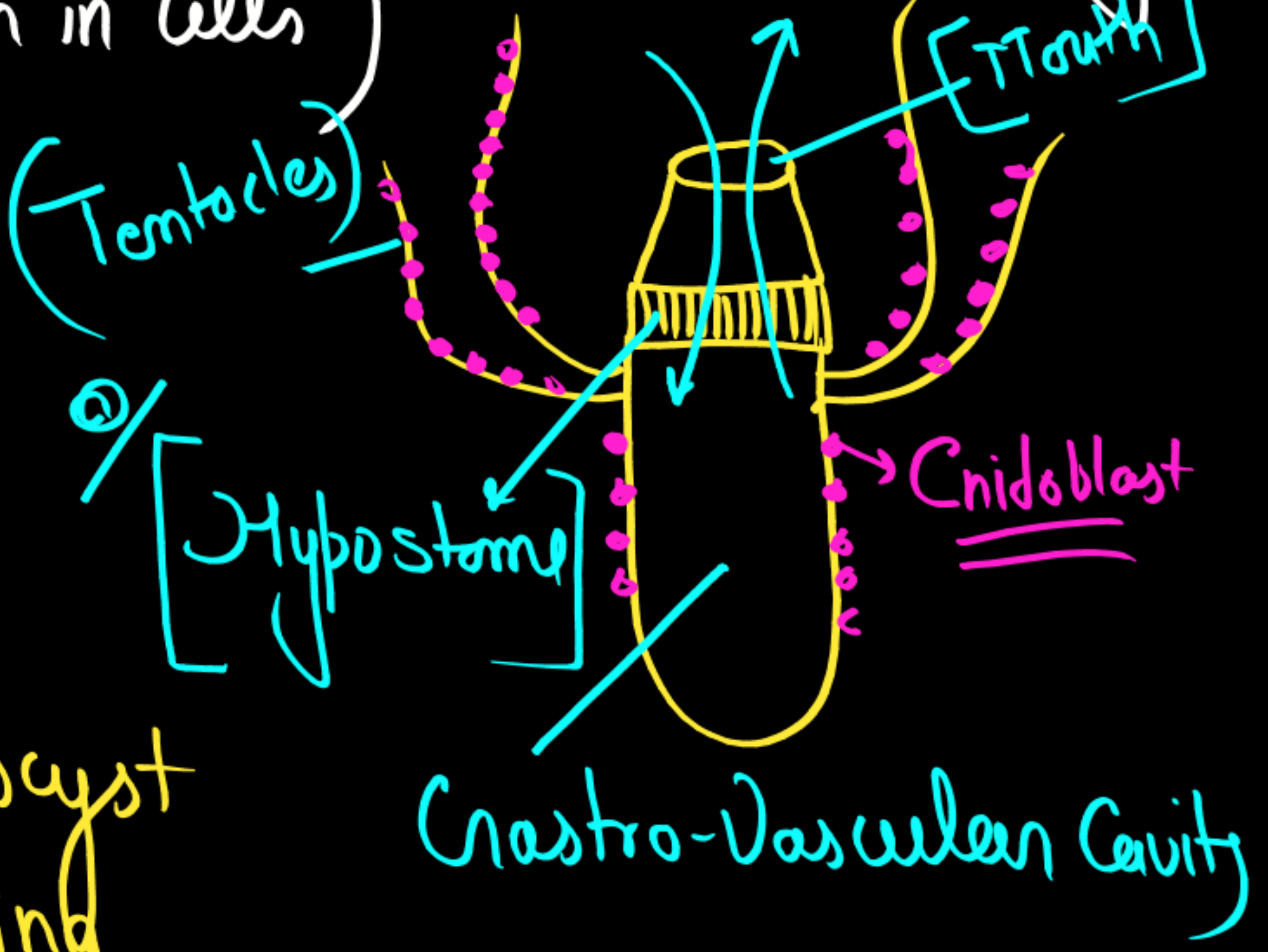
5) → Skeleton = In Some Cnidarians Calcarious ($CaCO_3$) Skeleton present (Corals)

6) → Digestion →

- ↳ Incomplete Digestive tract
- ↳ Single opening act as mouth & Anus (Blind Sac)
- ↳ Ist = Extra cellular by digestive Enzyme in GastroVascular Cavity
  - IInd = Intra cellular digestion (With in cells)

7) - Excretion }
8) - Respiration } Body Surface.

9) - Nervous System
- → Ist Time Develop
- Apolar types of Neuron
- Sensory Structure = Statocyst for = Balancing



(10) = Reproduction →

* Sexuality = H.M.B. & D.U.
  - → unisexual } Sexual Dimorphism
  - → Dioecious }

* Types of Repro
  - Asexual = Budding
  - Sexual → Fertilization = External

(11) = Development = Indirect (Larva tnt)

12. The name cnidaria is derived from the cnidoblasts or cnidocytes (which contain the stinging capsules or nematocysts) present on the tentacles and the body. = -nt in basal Disc.

Cnidoblasts are used for anchorage, defense and for the capture of prey.

13. Some of the cnidarians, e.g., corals have a skeleton composed of calcium carbonate.

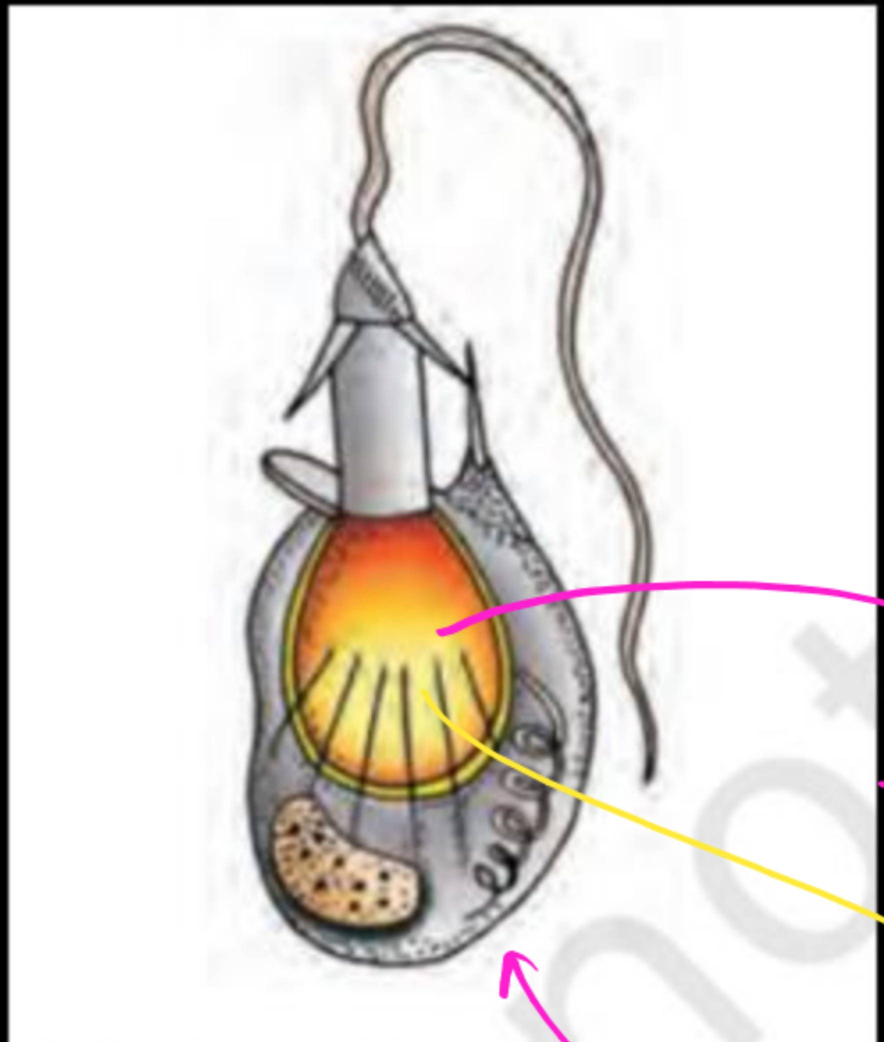


Figure 4.7 Diagrammatic view of Cnidoblast

(or Cnidocytes.)

14. Cnidarians exhibit two basic body forms called polyp and medusa. The former is a sessile and cylindrical form like Hydra, Adamsia, etc. whereas, the latter is umbrella-shaped and free- swimming like Aurelia or jelly fish. Those cnidarians which exist in both forms exhibit alternation of generation (Metagenesis), i.e., polyps produce medusae asexually and medusae form the polyps sexually (e.g., Obelia).

vvvImp

Cnidaria Show = Dimorphic Condition

[Polyp]

- Cylindrical Structure
- Sessile
- Asexual Reproduction

eg - Hydra, Gorgonia, Adamsia.

[Medusa]

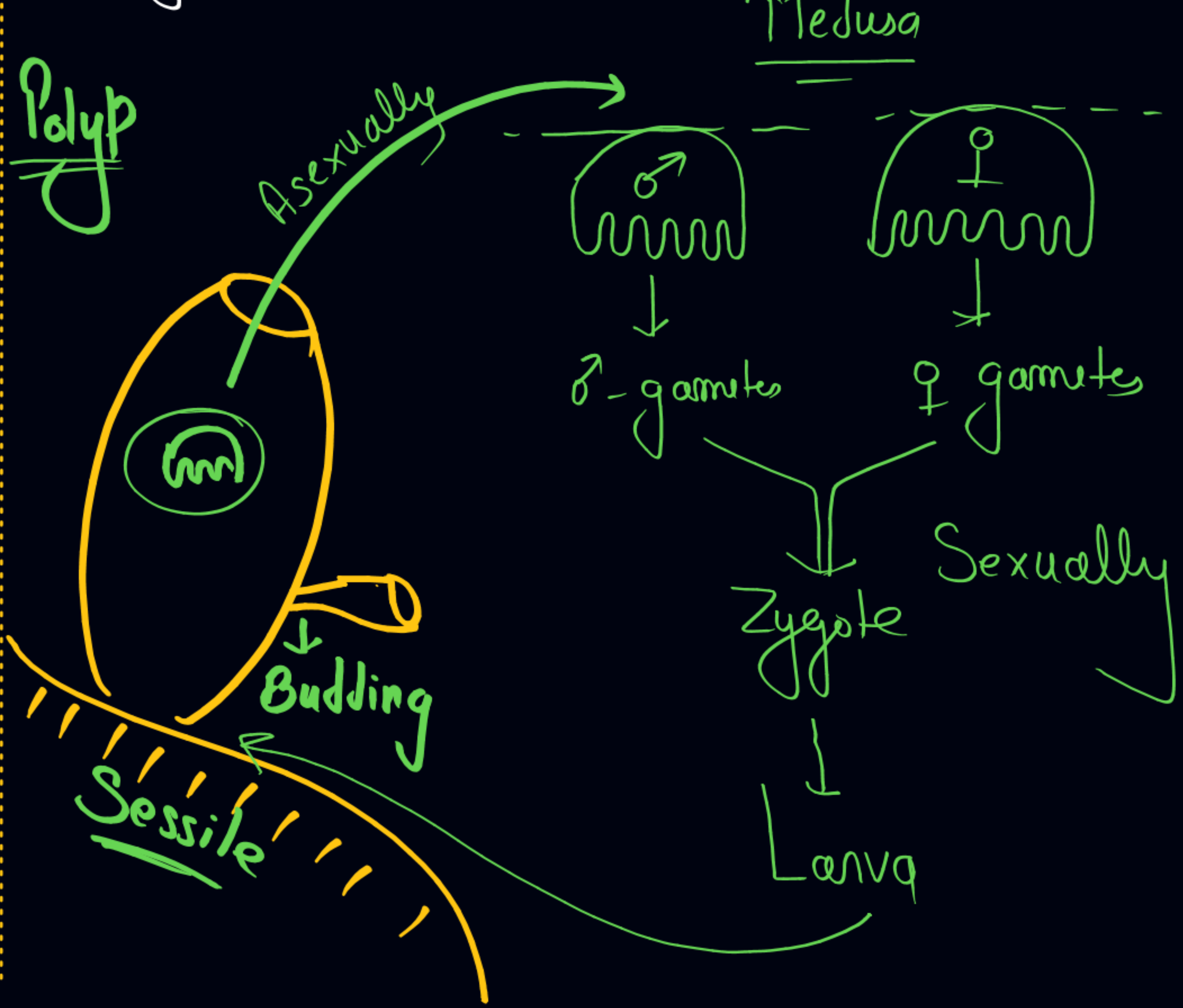
- Umbrella like
- Free Swimming
- Only Sexual Reproduction

eg = Aurelia (jelly fish)

Some Cnidaria Show both form (Polyp & Medusa) in their life cycle = Alternativelly = Alternation of Generation (Metagenesis)

eg - (Obelia & Physalia)

Life cycle of Obelia. →



Examples: Physalia (Portuguese man-of-war), Adamsia (Sea anemone), Pennatula (Sea-pen),





Gorgonia (Sea-fan) and Meandrina (Brain coral).

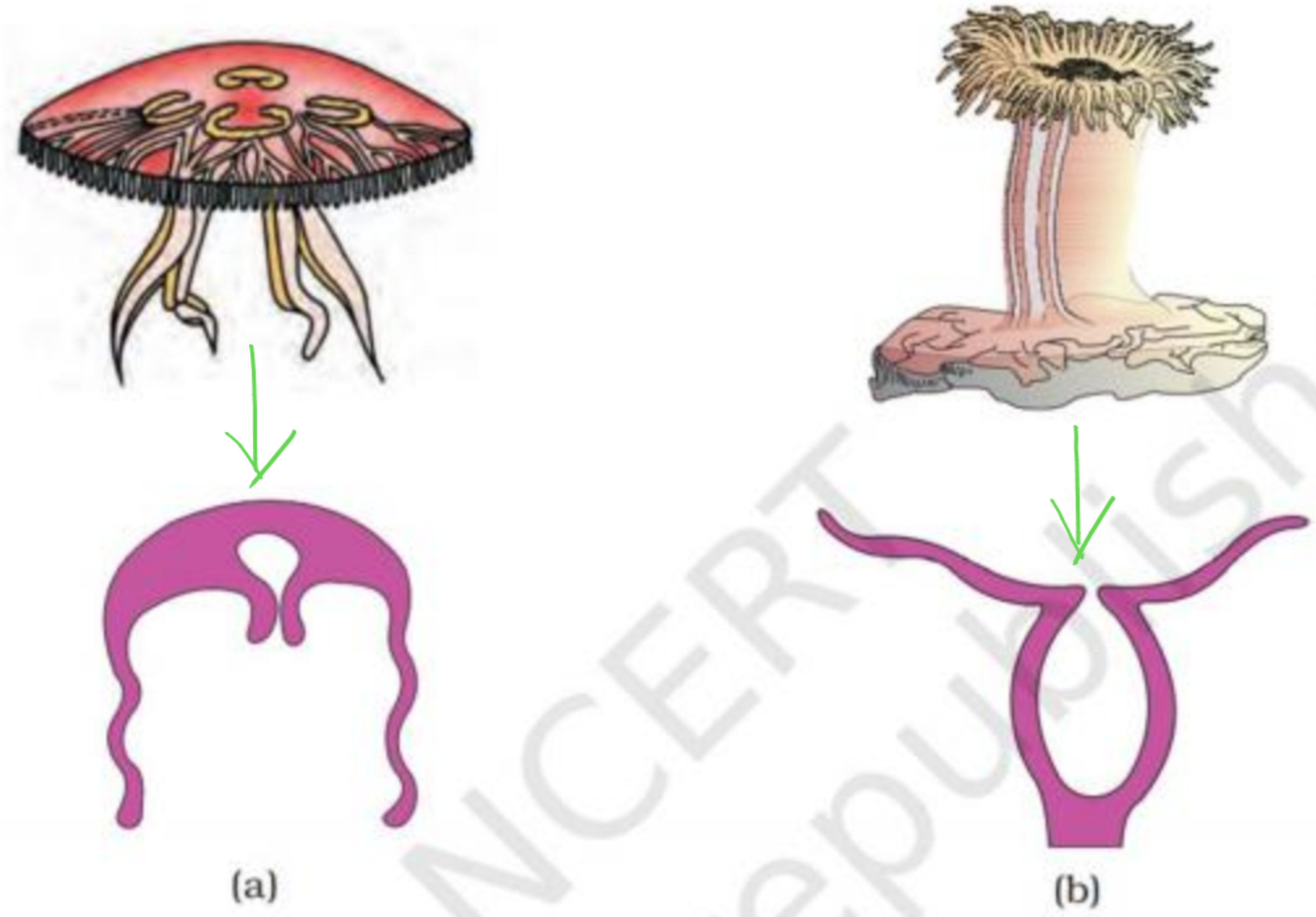
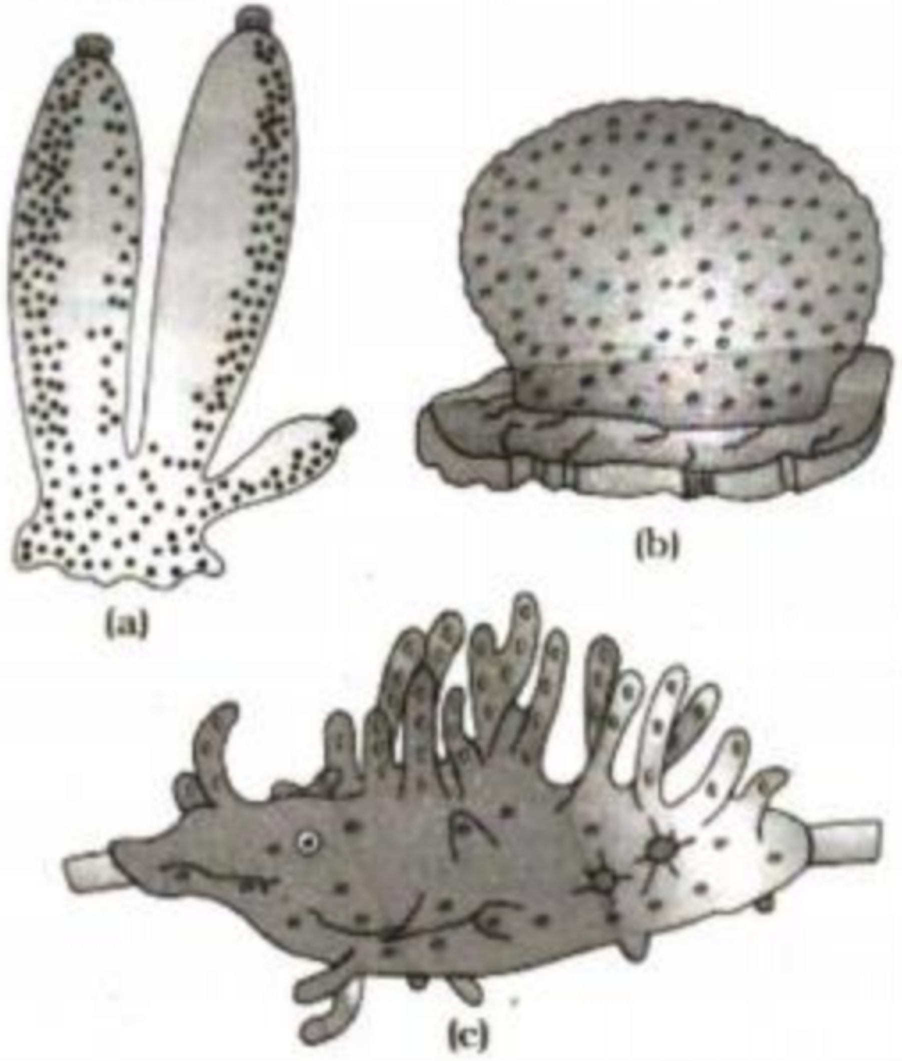
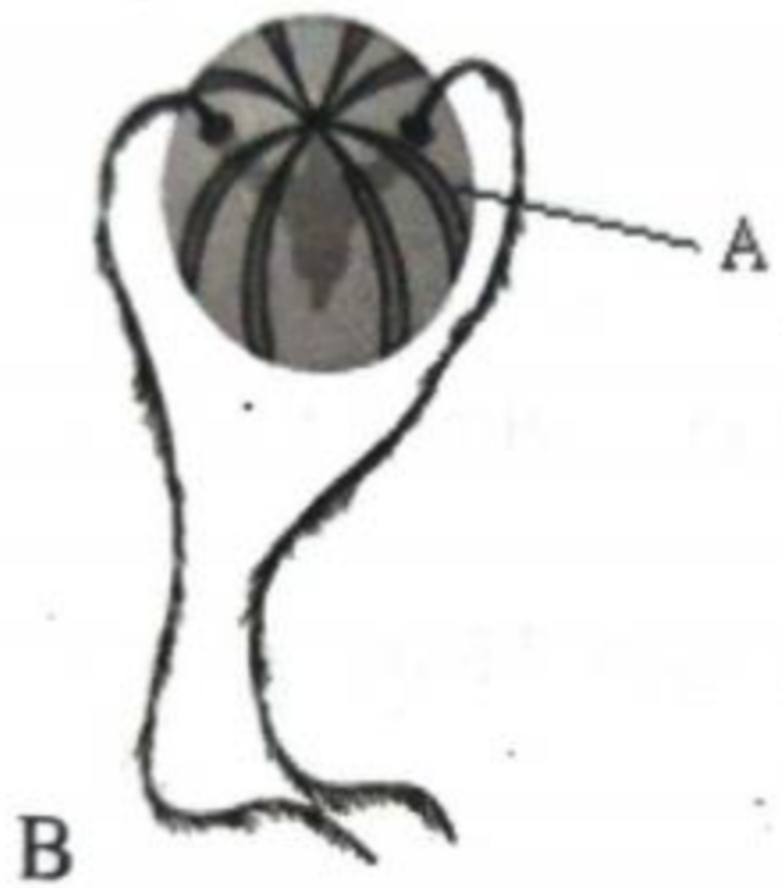


Figure 4.6 Examples of Coelenterata indicating outline of their body form : (a) *Aurelia* (Medusa) (b) *Adamsia* (Polyp)

Identify the given figures (a), (b) and (c) and select the correct option.



In the given diagram find out labeling A and given organism belongs to phylum B



(1) A = Ciliated comb plates, B = Ctenophora
(2) A = Dermal plicae, B = Coelenterata
(3) A = Dermal plicae, B = Ctenophora
(4) A = Epidermal foldings, B = Protozoa.

The characters given below are shown by

(i) Extracellular and intracellular digestion

(ii) Exclusively marine, radially symmetrical, diploblastic, tissue level of organisation

(iii) Bisexual, fertilisation external and indirect development

(iv) No asexual reproduction

(v) Presence of comb plates

(1) Cnidaria (2) Porifera

(3) Ctenophora (4) none of these.

Exclusive marine phylum is :

(1) Mollusca (2) Chordata

(3) Echinodermata (4) Coelenterata.

In sponges, ___A____ are the cells that line the spongocel and the canals, type of fertilization is ___B___ and mode of development is ___C___.

(1) A = Collar cells, B = External, C = Indirect

(2) A = Spicules, B = External, C = Direct

(3) A = Collar cells, B = Internal, C = Indirect

(4) A = Spicules, B = Internal, C = Direct

In most simple type of canal system of Porifera, which of the following ways exhibit water flow?

(1) Ostia → Spongocoel Osculum → Exterior

(2) Spongocoel → Ostia → Osculum → Exterior

(3) Osculum → Spongocoel → Ostia → Exterior

(4) Osculum → Ostia → Spongocoel → Exterior

Which of the following animal will exhibit tissue level of organization?

(1) Obelia

(2) Euspongia

(3) Taenia

(4) Two of the above

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ANIMAL KINGDOM

LECTURE - 4

ZOOLOGY



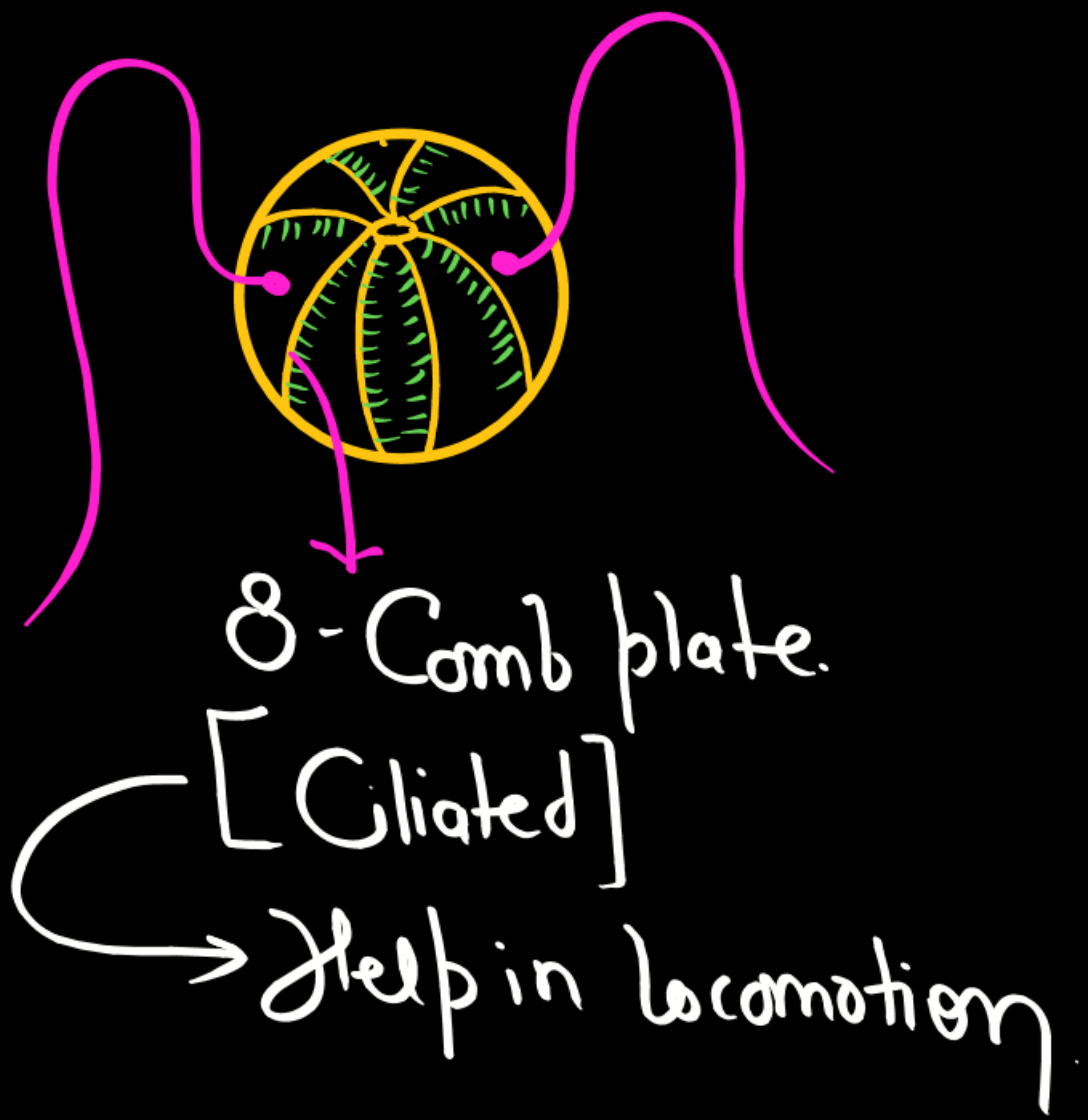
MD SIR

❑ TODAY'S GOAL -

- ❑ Phylum Ctenophore ✓
- ❑ Phylum Platyhelminthes ✓
- ❑ Phylum Aschelminthesis ✓

Phylum – Ctenophora

1. Ctenophores, commonly known as sea walnuts or comb jellies are exclusively marine, radially symmetrical, diploblastic organisms with tissue level of organisation.
2. The body bears eight external rows of ciliated comb plates, which help in locomotion.
3. Digestion is both extracellular and intracellular.



4. Bioluminescence (the property of a living organism to emit light) is well-marked in ctenophores.
5. Sexes are not separate. (H.M.B.) Reproduction takes place only by sexual means.
6. Fertilisation is external with indirect development.

Examples: Pleurobrachia and Ctenoplana.



Figure 4.8 Example of Ctenophora (*Pleurobrachia*)

Phylum – Platyhelminthes

Flattend — Worm = Dorso-Ventrally flattend

1)- Habitat = → Mostly Endoparasite
→ Some - Free living eg - Planaria.

2)- Level of Organisation = Organ / Organ System

3)- Symmetry = Bilateral Symmetry

4)- Germlayer = Triploblastic → Mesoderm Ist Time Develop.

5)- Coelom = Acoelomate → Solid Mesoderm

6) → Digestive System = Incomplete
 └→ Mostly Endoparasite

7) - Respiration = Anaerobic ↗ (Mostly)

8) - Excretion = Flame cells / Solinocytes / Protonephridia

9) = Nervous System = Ladder like → +nt in planaria



10) - Reproduction = Sexuality → H.M.B.

Types of Reproduction
- → Asexual = High Regeneration Power (In Planaria)
- → Sexual
  - → Self = Taenia
  - → Cross = Liver fluke

11) Development = Indirect (Larva +nt)

Parasitic Addaptation →

1) Hooks → 22 - 32 Hooks for adhesion (eg - Taenia)

2) → Suckers → Attachment / Ingestion of food. (Taenia & Fasciola Hepatica)

3) → Body Surface & Integument → Absorption of food

Integument → Protect from < HCl / Digestive Enzymes

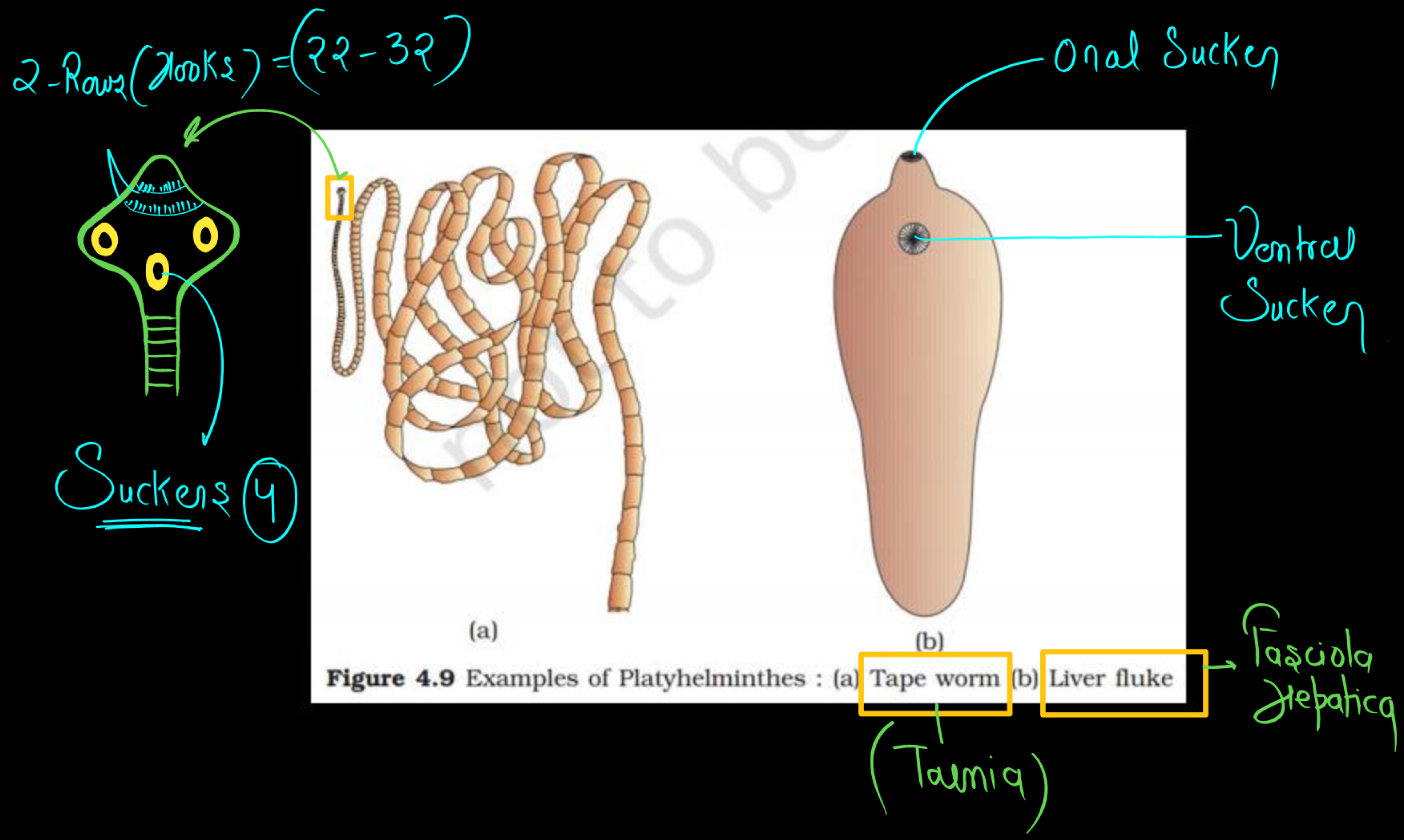


Figure 4.9 Examples of Platyhelminthes : (a) Tape worm (b) Liver fluke

eg → Tape Worm (Taenia)

→ Liver Fluke (Fasciola Hepatica)

vvImp

Lifecycle = Digenetic = Complete in two Host

- Pri. Host (Sexual) → Goat/Sheep.
- Sec. Host (Asexual) → Snail

Goat (Sexual Repro.)

Adult in Bile Duct

→ Miracidium Larva ①

→ (Snail): Sporocyst ② → Redia ③ (5-6) → Cercaria ④

Each Convert into 15-16 Cercaria

→ Asexual Reproduction (Parthenogenesis)

→ [Metacercaria] ⑤ Infective Stage for Pri. Host

→ Adult in Bile Duct

Phylum – Aschelminthes

Round Worm

1) - Habitat → Mostly Endoparasite

2) - Level of orga. → Organ System

3) - Symmetry → Bilateral

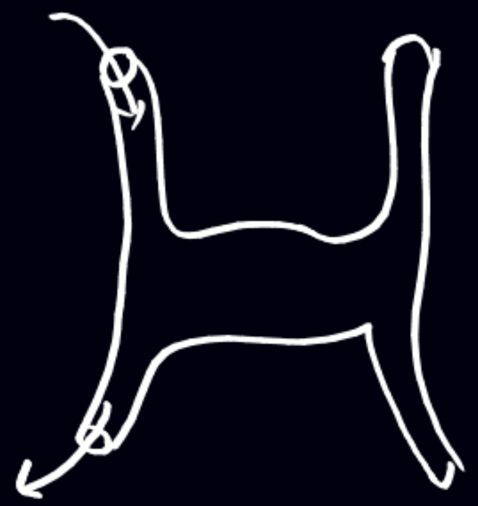
4) - Germ layer → Triploblastic.

5) - Coelom → Pseudocoelomate.

6) → Digestive System → Complete (Mouth & Anus both +nt)
with Muscular Pharynx → For ingestion of food

7) - Respiratory = Anaerobic.

8) - Excretory = Renette cells [H- Shape] →



9) - Nervous & Sensory = Brain + Ventral Nerve Cord + Solid, + Double

10) - Reproductive → Sexuality = D.U. < ♂ ♀ . Seperate

Sexes are separate (dioecious), i.e., males and females are distinct. Often females are longer than males.

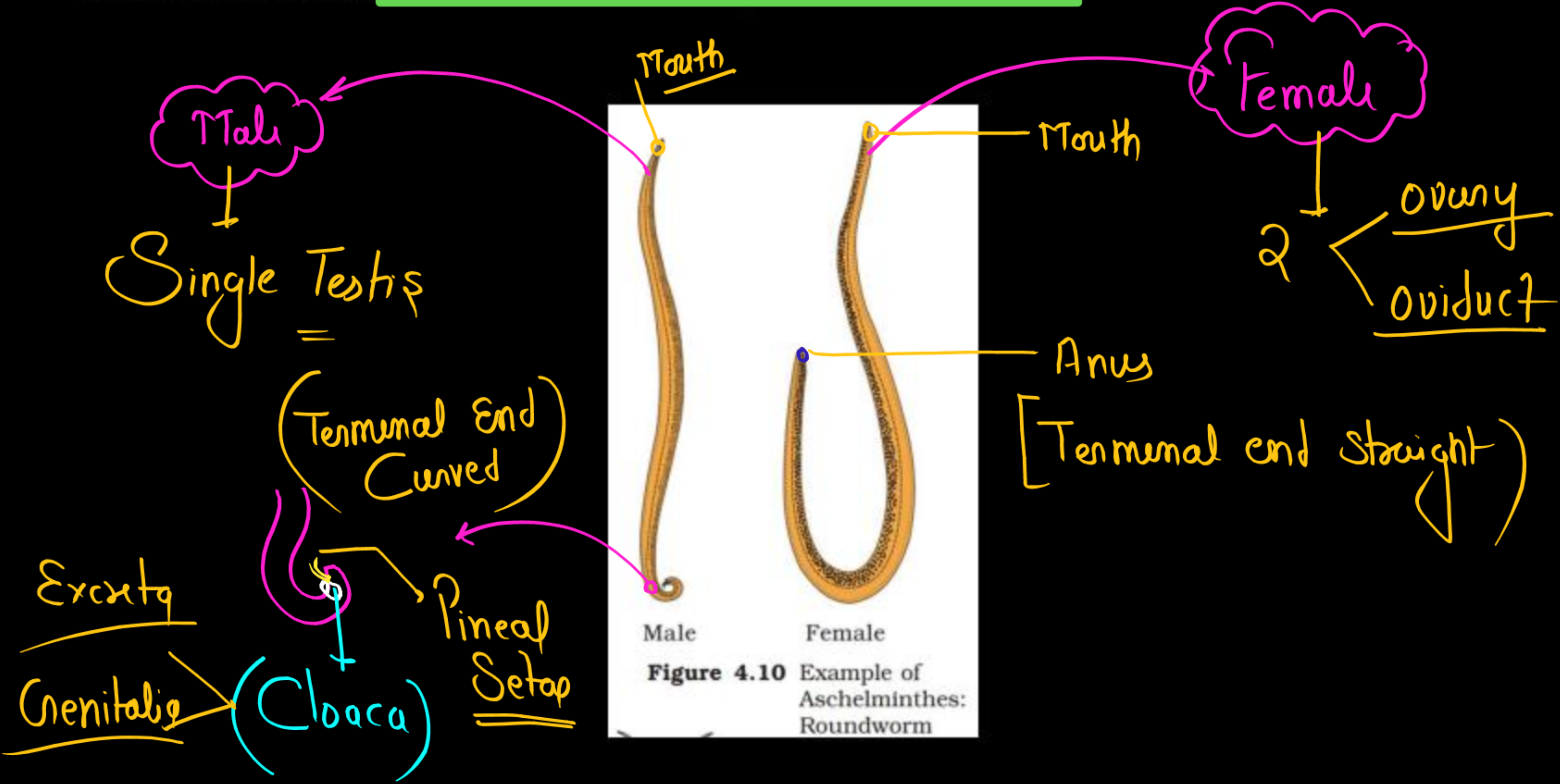


Figure 4.10 Example of Aschelminthes: Roundworm

* Types of Reproduction = Sexual
* Fertilization = Cross & Internal
* Development = Indirect
[larva tnt]

Life cycle = Monogenetic
+
Single Host (Human)

Life cycle = Digenetic
Two Host

Pri. Host (Human)

Sec. Host
Female Mosquito
[Culex & Aedes]

Examples : Ascaris (Roundworm), Wuchereria (Filaria worm), Ancylostoma (Hookworm).

THANK YOU !!

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ANIMAL KINGDOM

LECTURE - 5

ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

- ❑ Phylum Annelida
- ❑ Phylum Arthropoda
- ❑ Phylum Mollusca

Phylum – Annelida

Segmented body

1) Habitat =
- Marine → Nereis
- Freshwater → Leech
- Terrestrial → Earthworm

2) - Level of Organisation → Organ System

3) - Symmetry → Bilateral

4) - Germ layer → Triploblastic.

5) - Coelom → Eucoelomate ⟶ Schizocoelom.

6) - Segmentation → tnt = Metameric Segm..

7) - Digestive System = Complete (Extracellular) = Tube within Tube.

8) - Circulatory System = Closed Type Except Leech (open)

9) → Respiration
- → Moist Cuticle → Earthworm (Cutaneous Respiration) ← Leech
- → Parapodia → Nereis

10) - Excretion → Nephridial Excretion.

11) - Reproduction
- → Sexuality = HMTB = Earth Worm, Leech.
  - & D.U. = Nereis
- → Types of Repro. → Sexual → Fertilization
  - → External = Nereis
  - → Internal = Leech
  - → Cocoon = Earth

12) - Development
- → Indirect (Larva + nt) = Nereis
- → Direct → Leech & Earthworm

Note –

Locomotory Organ
- → Earthworm → Circual & Longitudenal Muscles + Setae
- → leech = Sucker
- Nereis = Parapodia → Respiration + Locomotion

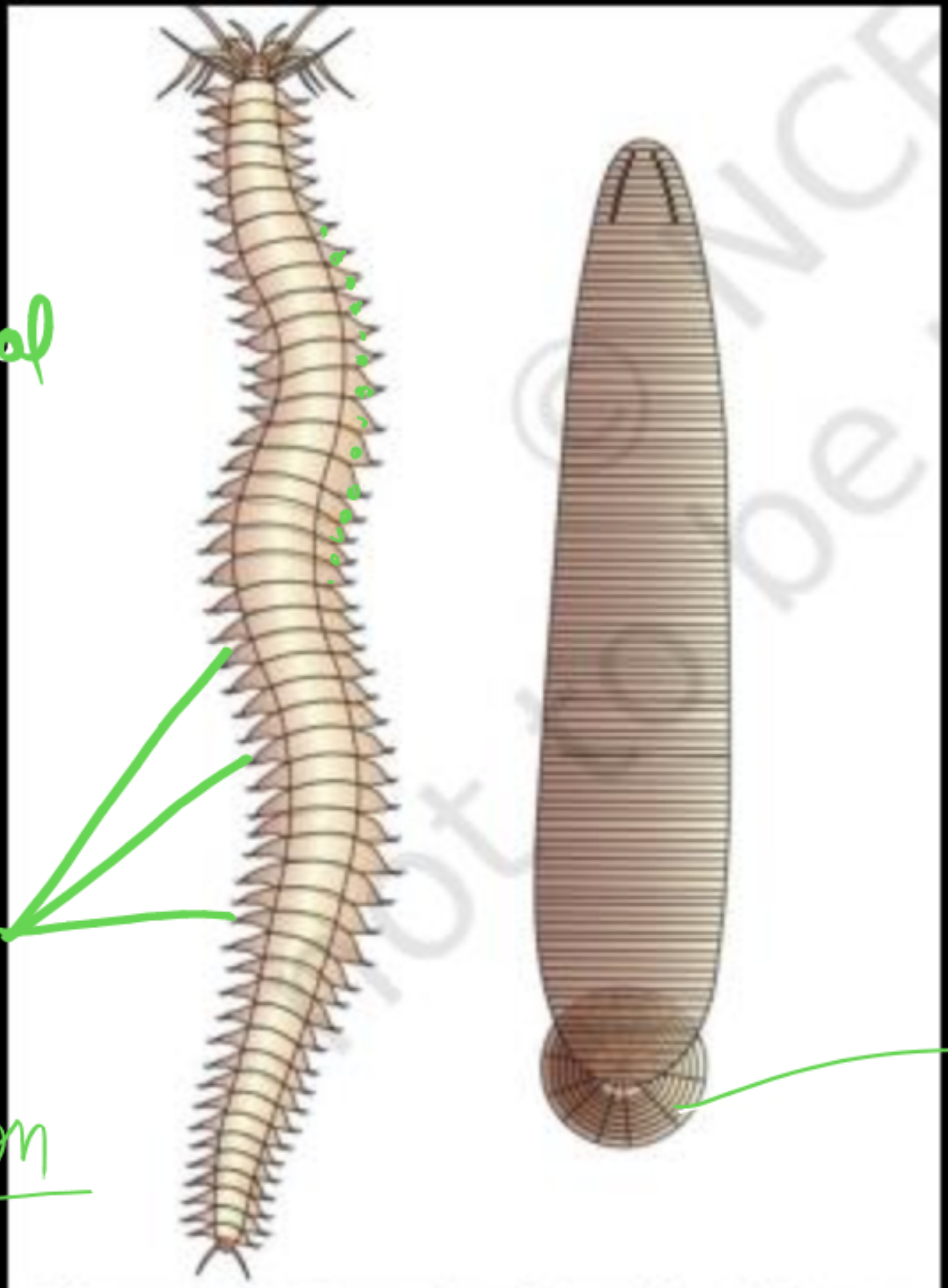


Figure 4.11 Examples of Annelida : (a) *Nereis* (b) *Hirudinaria*

Examples : Nereis, Pheretima (Earthworm) and Hirudinaria (Blood sucking leech).

Phylum – Arthropoda (arthros-joint, poda-appendages)

1. This is the largest phylum of Animalia which includes insects.
2. Over two-thirds of all named species on earth are arthropods.

3.) - Habitat →
- → Marine Water → Prawn Limulus
- → Fresh Water → Daphnia.
- → Terrestrial → Cockroach.
- → Air etc → Mosquito etc.

4.) - Level of Orga → Organ System

5.) - Symmetry → Bilateral

6) Germ layer → Triploblastic

7) Coelom → Eucoelom (Schizocoelom)

8) Segmentation → +nt Metameric Segmentation

9) Body Division →

Head + Trunk → Chilopoda

Head + Thorax + Abdomen → Insects

Cephalothorax + Abdomen → Crustaceans

↓

Aquatic arthropods.

10) - Striated Muscles

↓

I[st] time develop in Arthropoda.

11) Digestive System → Complete (Extracellular) - Tube within Tube

12) Circulatory System → Open type
- → Respiratory Pig = -nt
- → Blood = Haemolymph
- → Blood Cavity = Haemocoel

13) Respiratory System
- → Gills → Prawn
- → Book Gills → Limulus
- → Book lungs → Scorpian, Spider
- Trachia → Insecta (Cockroach)

14) Excretory System
- → Malpighian Tubules → Insecta
- → Antennary gland / Green gland → Crustacians

15) Nervous & Sensory
- Brain + Nerve Cord
- Eyes
- Antennae
- → Mouth part
- etc.

Reproduction →

Sexuality ⟶ D.U.

Types of Repro. ⟶ Sexual

Fertilization → Internal

Development → Direct = Cockroach & Grasshopper.

↳ Indirect = Mosquito etc.

Examples: Economically important insects –

Apis (Honey bee),

Bombyx (Silkworm),

Laccifer (Lac insect)

Vectors – Anopheles, Culex and Aedes (Mosquitoes)

Gregarious pest – Locusta (Locust)

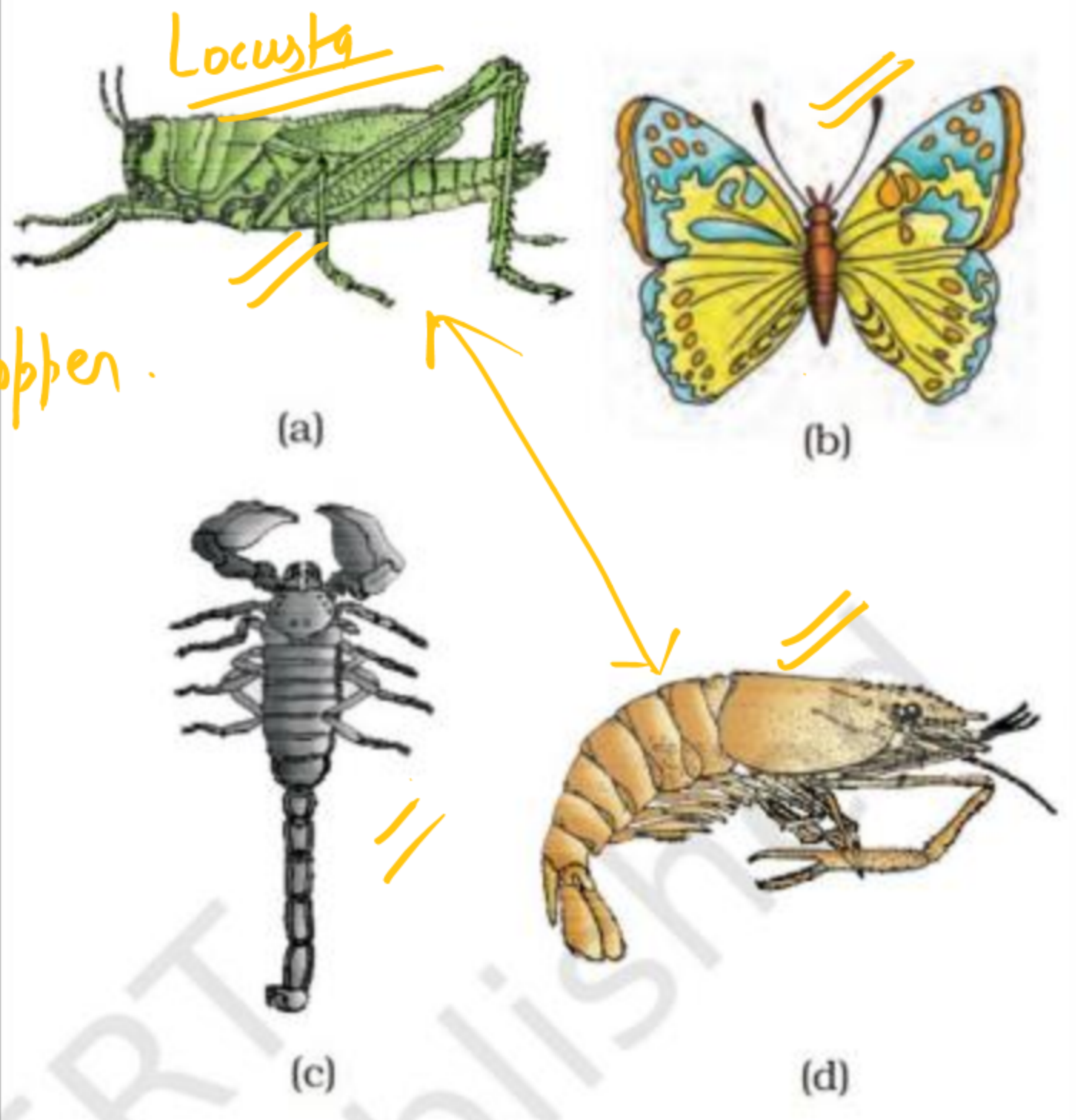
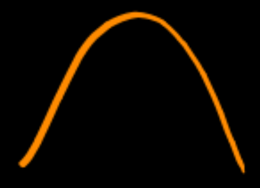


Figure 4.12 Examples of Arthropoda: (a) Locust (b) Butterfly (c) Scorpion (d) Prawn

Phylum – Mollusca (2nd largest phylum)

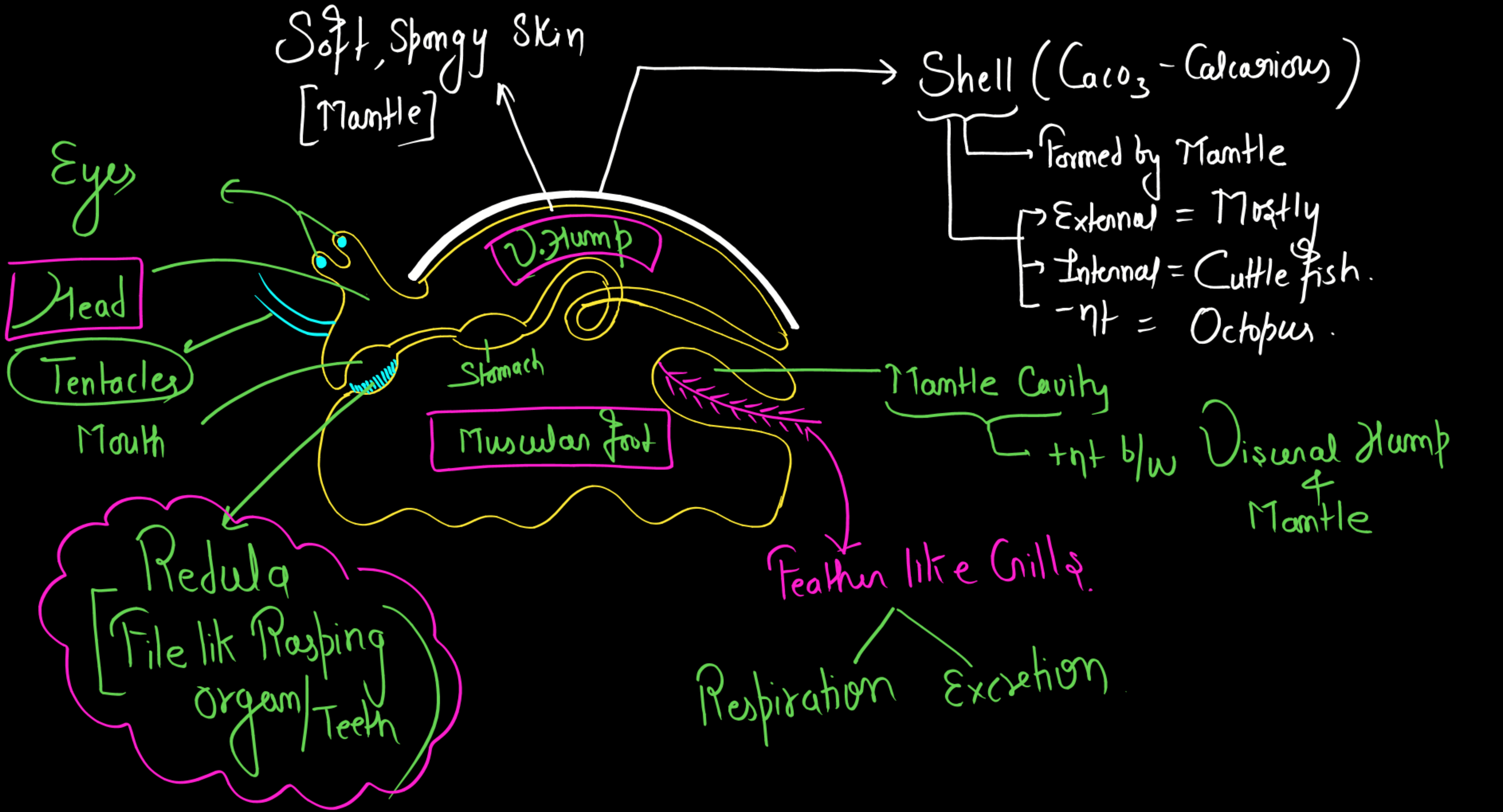
Soft - Skin

1. Habitat →
   - Marine Water
   - Fresh Water
   - Terrestrial
2. Germ layer → Triploblastic
3. Symmetry → Bilateral
4. Coelom → Eucoelomate (Schizocoelom)
5. Level of organisation → Organ System
6. Segmentation → unsegmented.
7. Body form → Body divided in to
   - Visceral Hump
   - Muscular foot
   - Head.



8

- Body is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump.
- A soft and spongy layer of skin forms a mantle over the visceral hump.



Soft, Spongy Skin
[Mantle]
Shell (CaCO3 - Calcarious)
Formed by Mantle
External = Mostly
Internal = Cuttle fish.
-nt = Octopus.
Eyes
Head
Tentacles
Mouth
V.Hump
Stomach
Muscular foot
Mantle Cavity
+nt b/w Visceral Hump & Mantle
Redula
[File lik Rasping organ/Teeth]
Feather like Gills.
Respiration
Excretion

Digestive System →

Circulation → open type Except Octopus.

Respiration →

Excretion →

Nervous & Sensory → Tentacles present on Head.

Reproduction → Sexuality → D.U.

Types of Repro. → Sexual

Fertilization → Internal

Development = → Indirect → Mostly.
└ Direct → Octopus

Examples: Pila (Apple snail), Pinctada (Pearl oyster), Sepia (Cuttlefish), Loligo (Squid), Octopus (Devil fish), Aplysia (Sea hare), Dentalium (Tusk shell) and Chaetopleura (Chiton).

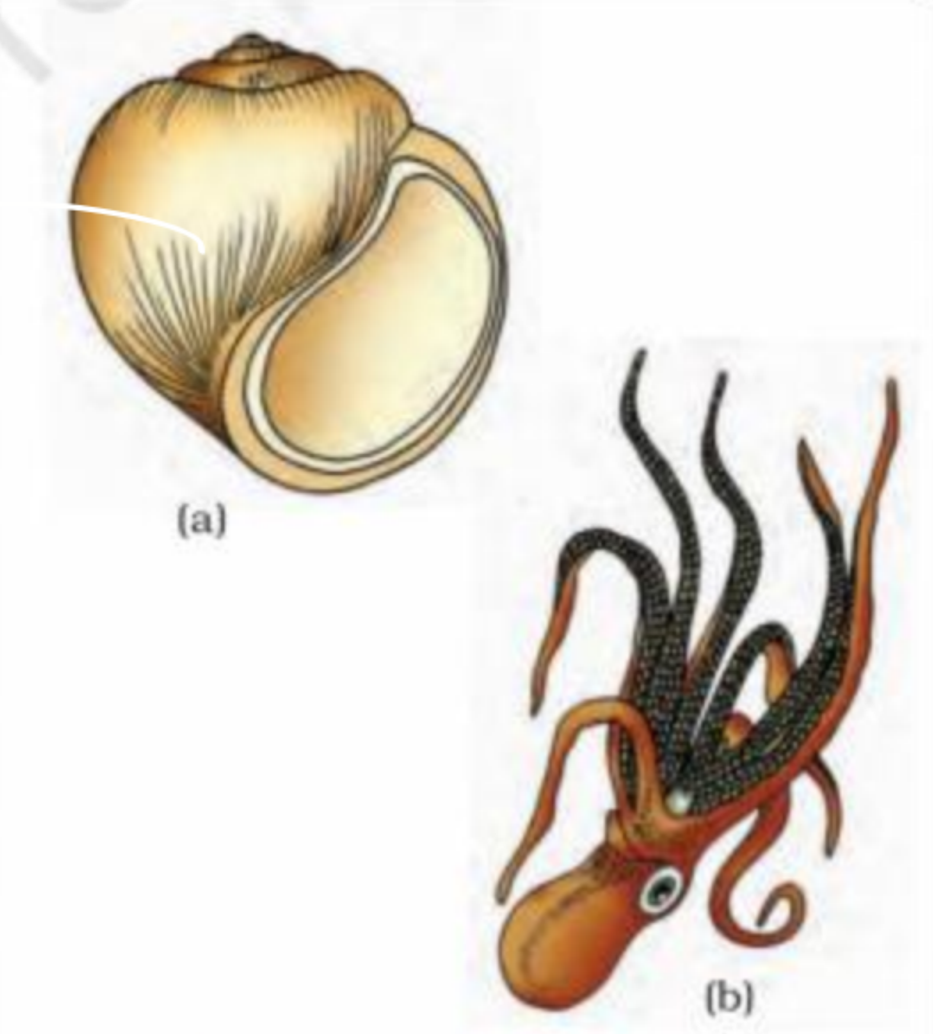


Figure 4.13 Examples of Mollusca : (a) *Pila* (b) *Octopus*

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ANIMAL KINGDOM

LECTURE - 6

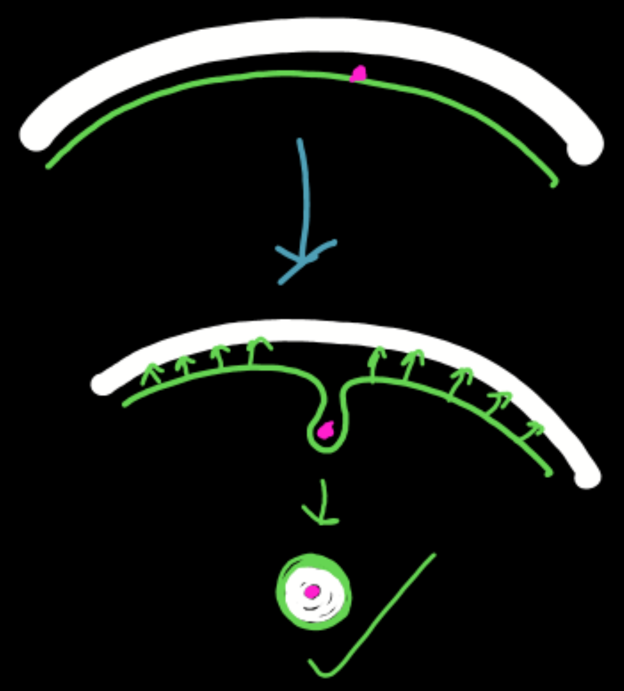
ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

- ❑ Phylum Echinodermata ✓
- ❑ Phylum Hemichordate
- ❑ Phylum Chordata



Phylum - Echinodermata

Echino → Spine; dermata → Dermis (Skin)

1) → Habitat → Only in Marine Water.

2) → Level of Organisation → Organ System level of Organisation.

3) - Symmetry →
- Larva = Bilateral
- Adult = Radial.

4) → Germ layer. → Triploblastic.

5) - Coelom. → Eucoelom → (Enterocoelom)

7) - Body Plan → Tube With in Tube (Deuterostome) → 1st - Anus → Mouth.

8) - Segmentation → unsegmented.

9) → Digestive System → Complete (Tube With in Tube)

10) → Circulatory " → open type [Reduced Type)
→ Heart & Blood Vess. -nt)

11) → Respiratory " → Body Surface (By Diffusion)

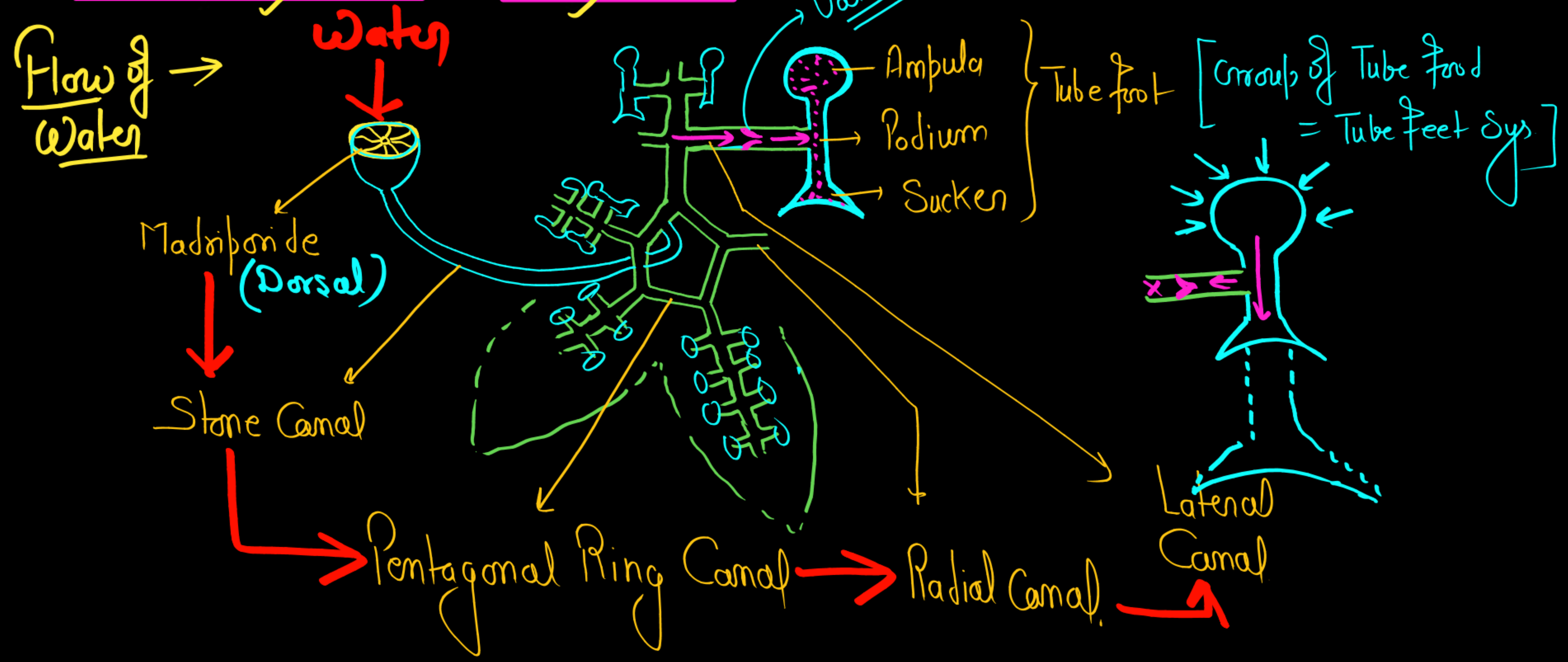
12) - Excretory " → (-nt) = Excretory Sub. (Ammonia) diffused through body Surface.

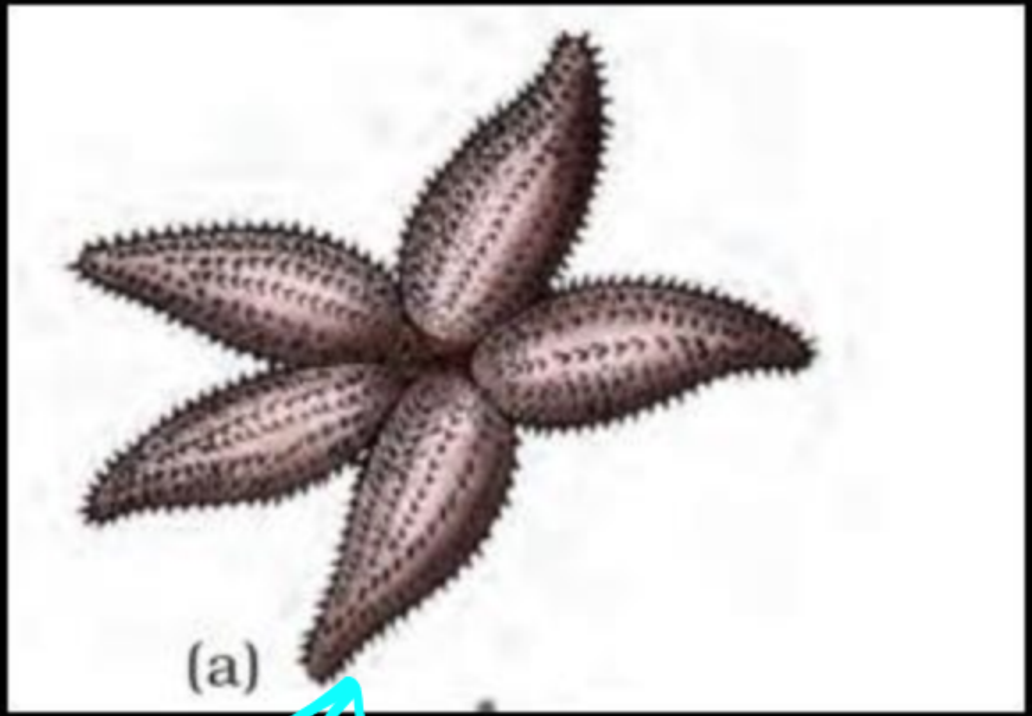
13) - Nervous " → Ventral, Solid, Double.

14) - Reproductive " → Sexuality → D.U.
Reproduction → Sexual
Fertilization → External ✓

15) - Development = Indirect

The most distinctive feature of echinoderms is the presence of water vascular system which helps in locomotion, capture and transport of food and respiration.





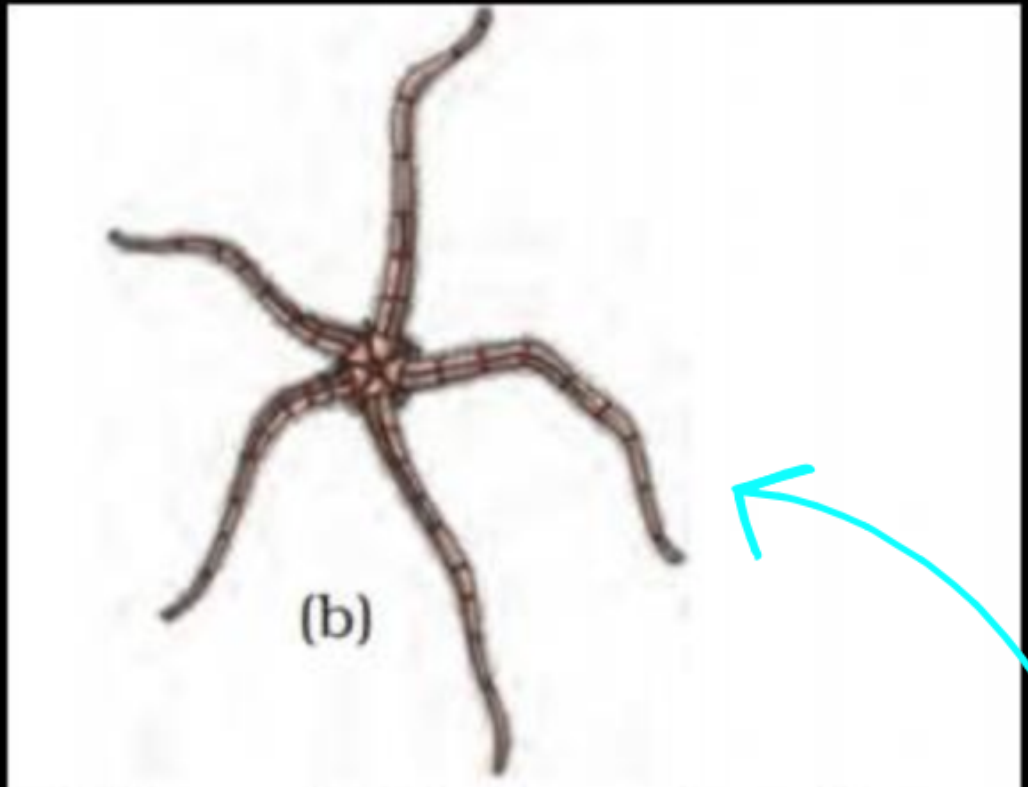
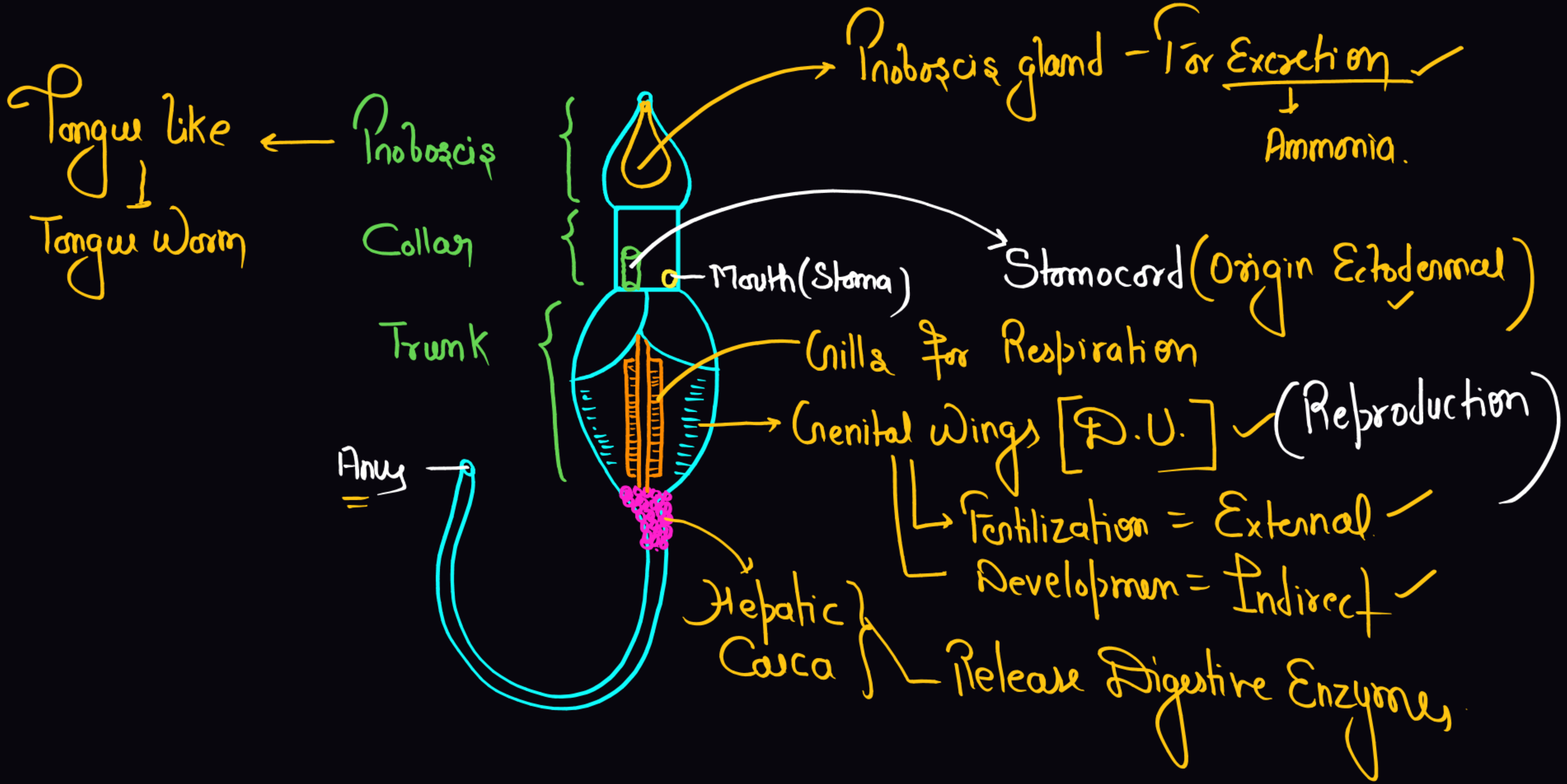


Figure 4.14 Examples of Echinodermata : (a) *Asterias* (b) *Ophiura*

Examples: Asterias (Star fish), Echinus (Sea urchin), Antedon (Sea lily), Cucumaria (Sea cucumber) and Ophiura (Brittle star).

Phylum – Hemichordate (Tongue Worm)

* Habitat → Only fnt in Marine Water.
* Symmetry → B/L
* Level of orga. → Organ Sys.
* Coelom → Eucoelom (Entero.)
* Segmentation → Unsegmented
* Germ layer → Triploblastic.
* Digestive Sys. Complete.
* Circulatory → Open type.
* Excretory → Proboscis gland.
* Respiratory → Gills.
* Reproduction → ✓


Proboscis gland - For Excretion
Ammonia
Tongue like
Tongue Worm
Proboscis
Collar
Trunk
Mouth (Stoma)
Stomocord (Origin Ectodermal)
Gills for Respiration
Genital Wings [D.U.]
(Reproduction)
Fertilization = External
Development = Indirect
Anus
Hepatic Caeca
Release Digestive Enzymes

- Examples: Balanoglossus and Saccoglossus.

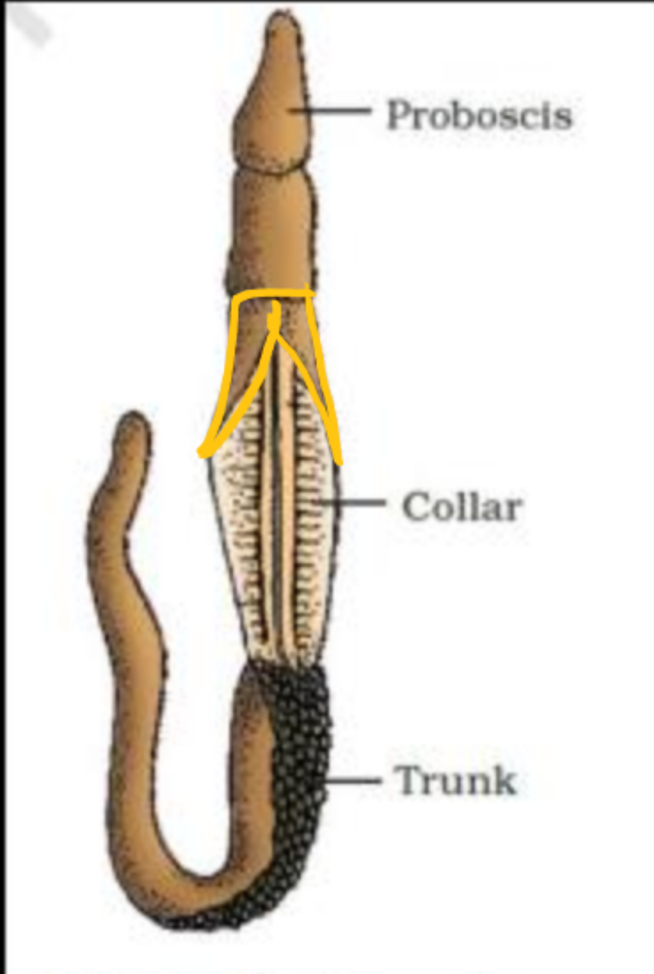


Figure 4.15 *Balanoglossus*

Phylum	Level of Organisation	Symmetry	Coelom	Segmentation	Digestive System	Circulatory System	Respiratory System	Distinctive Features
Porifera	Cellular	Various	Absent	Absent	Absent	Absent	Absent	Body with pores and canals in walls.
Coelenterata (Cnidaria)	Tissue	Radial	Absent	Absent	Incomplete	Absent	Absent	Cnidoblasts present.
Ctenophora	Tissue	Radial	Absent	Absent	Incomplete	Absent	Absent	Comb plates for locomotion.
Platyhelminthes	Organ & Organ-system	Bilateral	Absent	Absent	Incomplete	Absent	Absent	Flat body, suckers.
Aschelminthes	Organ-system	Bilateral	Pseudo coelomate	Absent	Complete	Absent	Absent	Often worm-shaped, elongated.
Annelida	Organ-system	Bilateral	Coelomate	Present	Complete	Present	Absent	Body segmentation like rings.
Arthropoda	Organ-system	Bilateral	Coelomate	Present	Complete	Present	Present	Exoskeleton of cuticle, jointed appendages.
Mollusca	Organ-system	Bilateral	Coelomate	Absent	Complete	Present	Present	External skeleton of shell usually present.
Echinodermata	Organ-system	Radial	Coelomate	Absent	Complete	Present	Present	Water vascular system, radial symmetry.
Hemichordata	Organ-system	Bilateral	Coelomate	Absent	Complete	Present	Present	Worm-like with proboscis, collar and trunk.
Chordata	Organ-system	Bilateral	Coelomate	Present	Complete	Present	Present	Notochord, dorsal hollow nerve cord, gill slits with limbs or fins.

H.W

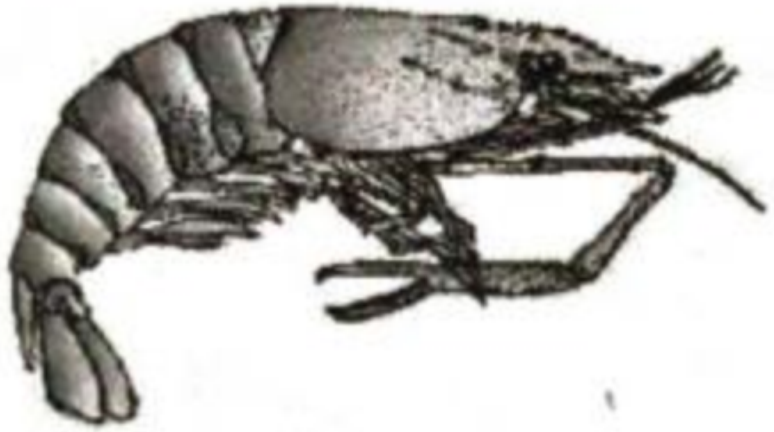
Pick the odd one out:

(1)Bombyx
(2)Anopheles
(3)Apis
(4)Neries.

Examples of gregarious pest and living fossil are respectively:

(1) Locusta and Apis
(2) Apis and Limulus
(3) Limulus and Locusta
(4) Locusta and Limulus.

In the given organism, body is covered by __________ exoskeleton and circulatory system is __________ type.



(1) non-chitinous, open (2) non-chitinous, close

(3) chitinous, open (4) chitinous, close

One of the representatives of Phylum Arthropoda is :
(NEET-2013)

(1)Puffer fish
(2)Flying fish
(3)Cuttle fish
(4)Silver fish

Which of the following features is not present in thePhylum Arthropoda? [NEET Phase 1-2016)

(1)Parapodia
(2)Jointed appendages
(3)Chitinous exoskeleton
(4)Metameric segmentation

Match the following organisms with their respective characteristics :-
[NEET-2019]

(a) Pila	(i) Flame cells
(b) Bombyx	(ii) Comb plates
(c) Pleurobrachia	(iii) Radula
(d) Taenia	(iv) Malpighian tubules

Select the correct option from the following (a) (b)(c)(d)
(1)(iii) (ii) (i) (iv)
(2) (i) (iv) (ii) (1)
(3) (i) (iv) (iii) (i)
(4) (iii) (ii) (iv) (i)

Important characteristic that hemichordates share with chordates is :
[NEET-2017]

(1) ventral tubular nerve cord
(2) pharynx with gill slits
(3) pharynx without gill slits
(4) absence of notochord

Identify the figures (a), (b), (c) and (d) given below and select the correct option.

(a) 

(b) 

(c) 

(d) 

(1) (a)-Locust, (b)-Scorpion, (c)-Prawn, (d)-Pila
(2) (a)-Locust, (b)-Prawn, (c)-Scorpion, (d)-Pila
(3) (a)-Locust, (b)-Scorpion, (c)-Prawn, (d)-Snail
(4) (a)-Butterfly, (b)-Scorpion, (c)-Prawn, (d)-Pila

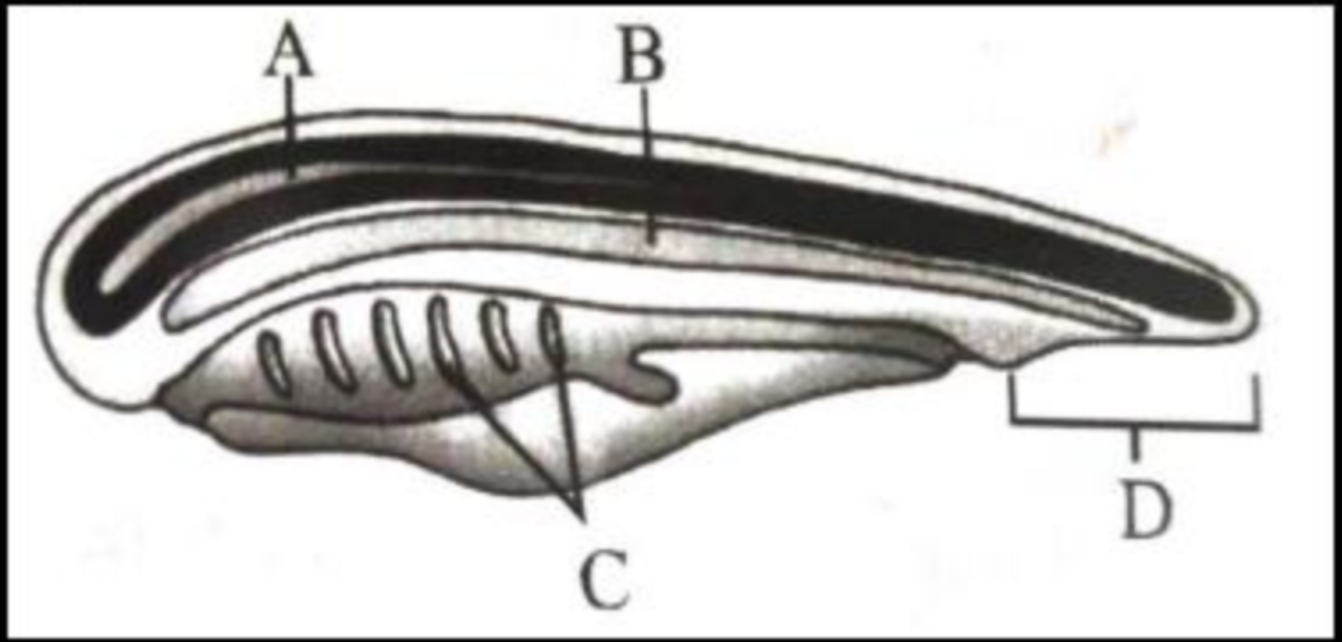
Out of the following organs, how many are concerned with respiration?
[Book-gills, green glands, trachea, spiracles,Malpighian tubules, coxal glands]

(1) 2
(2) 3
(3) 4
(4) 6

Identify the animal on the basis of following features:
(i). Body divisible into proboscis, collar and trunk.
(ii) Respiration by gills.
(iii) Excretion by proboscis glands.

(1) Sepia
(2) Balanoglossus
(3) Salpa
(4) Amphioxus.

Animals belonging to Phylum Chordata are fundamentally characterised by the presence of structures noted as A, B, C and D. Identify them and select the correct option



(1) A-Notochord, B-Nerve cord, C-Gill slits, D-Post-anal part
(2) A-Nerve cord, B-Notochord, C-Gill slits, D-Post-anal part
(3) A-Nerve cord, B-Notochord, C-Post-anal part, D-Gill slits
(4) A-Nerve cord, B-Gill slits, C-Notochord, D-Post-anal part

THANK YOU !!

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LECTURE - 7

ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

- ❑ Phylum Chordata ✓

Phylum – Chordata

- Animals belonging to phylum Chordata are fundamentally characterized by the presence of a notochord, a dorsal hollow nerve cord, paired pharyngeal gill slits and post anal part/tail.

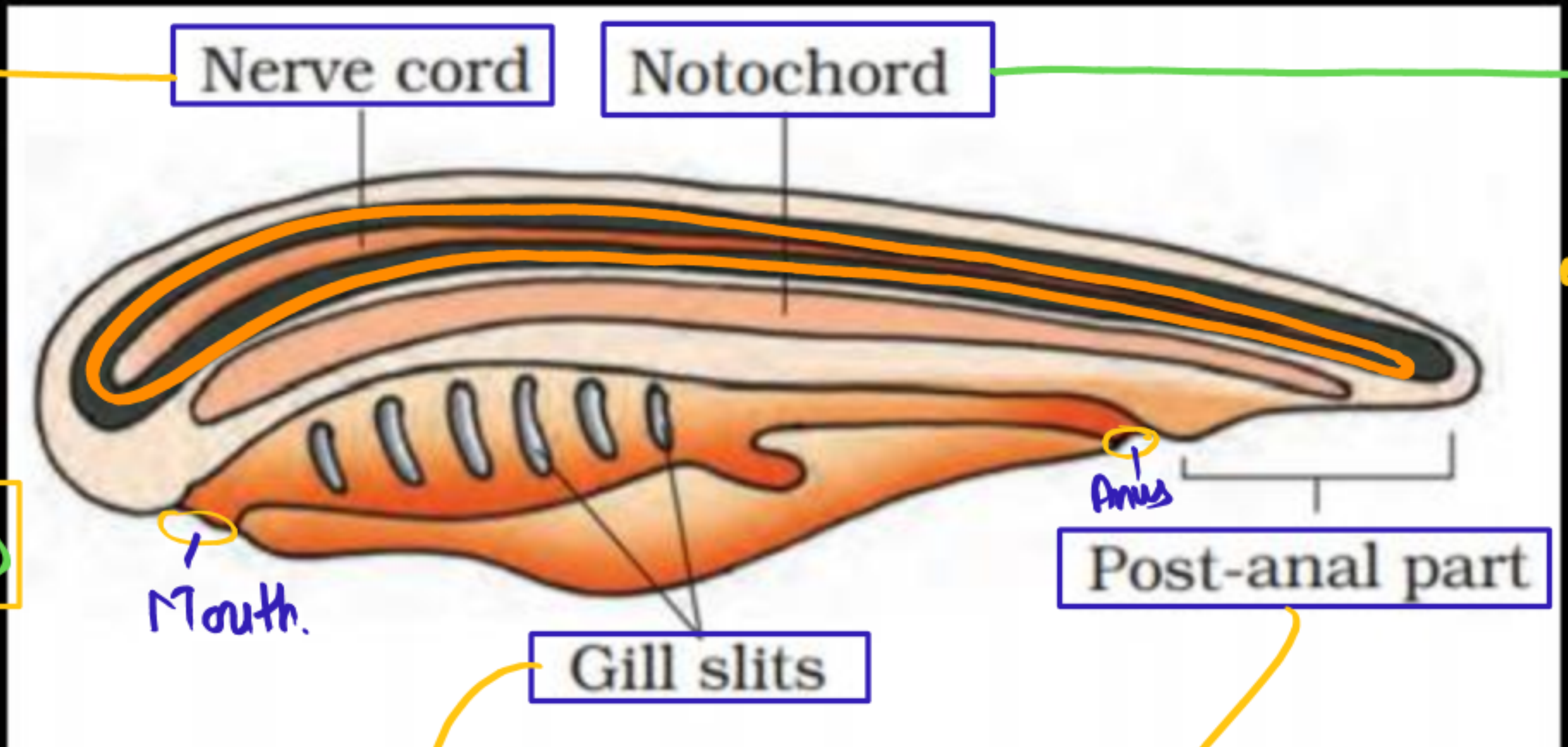


Figure 4.16 Chordata characteristics

Nerve cord

Origin = Ectodermal

↓ tnt in

Nonchordates
- Ventral
- Double
- Solid

Chordates
- Dorsal
- Single
- Hollow

Notochord

Origin = Mesodermal

- Only tnt in Chordata

⇓

- tnt below Nerve Cord & above - alementary Canal
- In Some Chordate, Notocord Replace by Vertebral columns.

⇓

Callet → Vertebrata

Gill slits

{In Some higher Chordates tnt only in Embryonic Stage}

Post-anal part

(Balancing)

- These are bilaterally symmetrical, triploblastic, coelomate with organ-system level of organisation.
- They possess a post anal tail and a closed circulatory system.

Table 4.1 Comparison of Chordates and Non-chordates

S.No.	Chordates	Non-chordates
1.	Notochord present.	Notochord absent.
2.	Central nervous system is dorsal, hollow and single.	Central nervous system is ventral, solid and double.
3.	Pharynx perforated by gill slits.	Gill slits are absent.
4.	Heart is ventral.	Heart is dorsal (if present).
5.	A post-anal part (tail) is present.	Post-anal tail is absent.

[Phylum - Chordata.]

(Brain box)

Q// [Protochordata]
or
[Acraniata] = Cranium -nt (Brain box or)

→ [Sub-Phylum]

[Urochordata] (Tail)
or
[Tunicata]
↳ Tunic = Outer Covering

(Notochord +nt only in tail of Larva)
- -nt in adult.

eg → Ascidia, Doliolum, Salpa.

[Cephalochordata] (Head)
- Notochord +nt Head to tail.
- +nt in both < Larva, Adult
- eg → Branchiostoma or Amphioxus or Lancelet.

Q/ [Euchordata]
or
[Craniata] = Cranium +nt

→ Q// [Sub phylum] Q//
(Vertebrata)

Q//

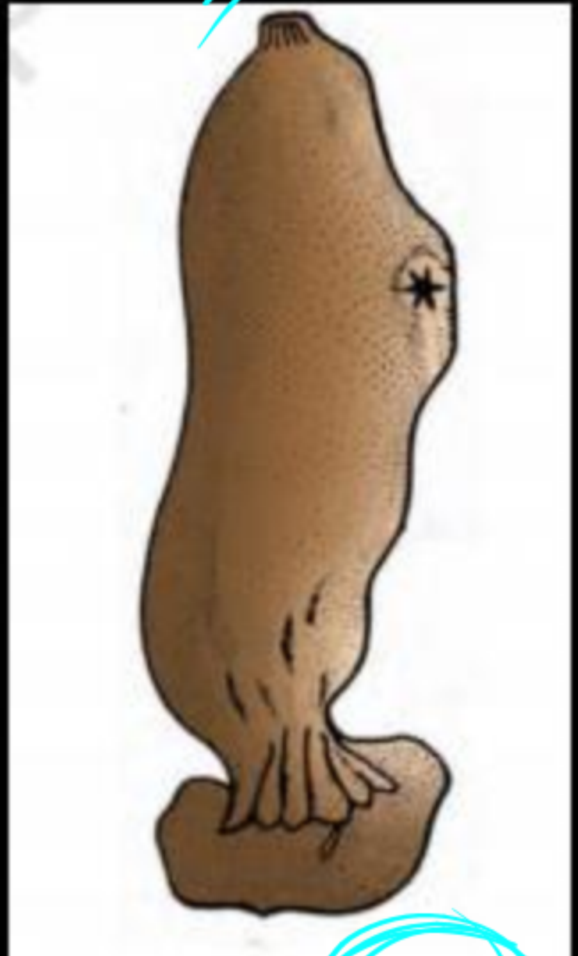
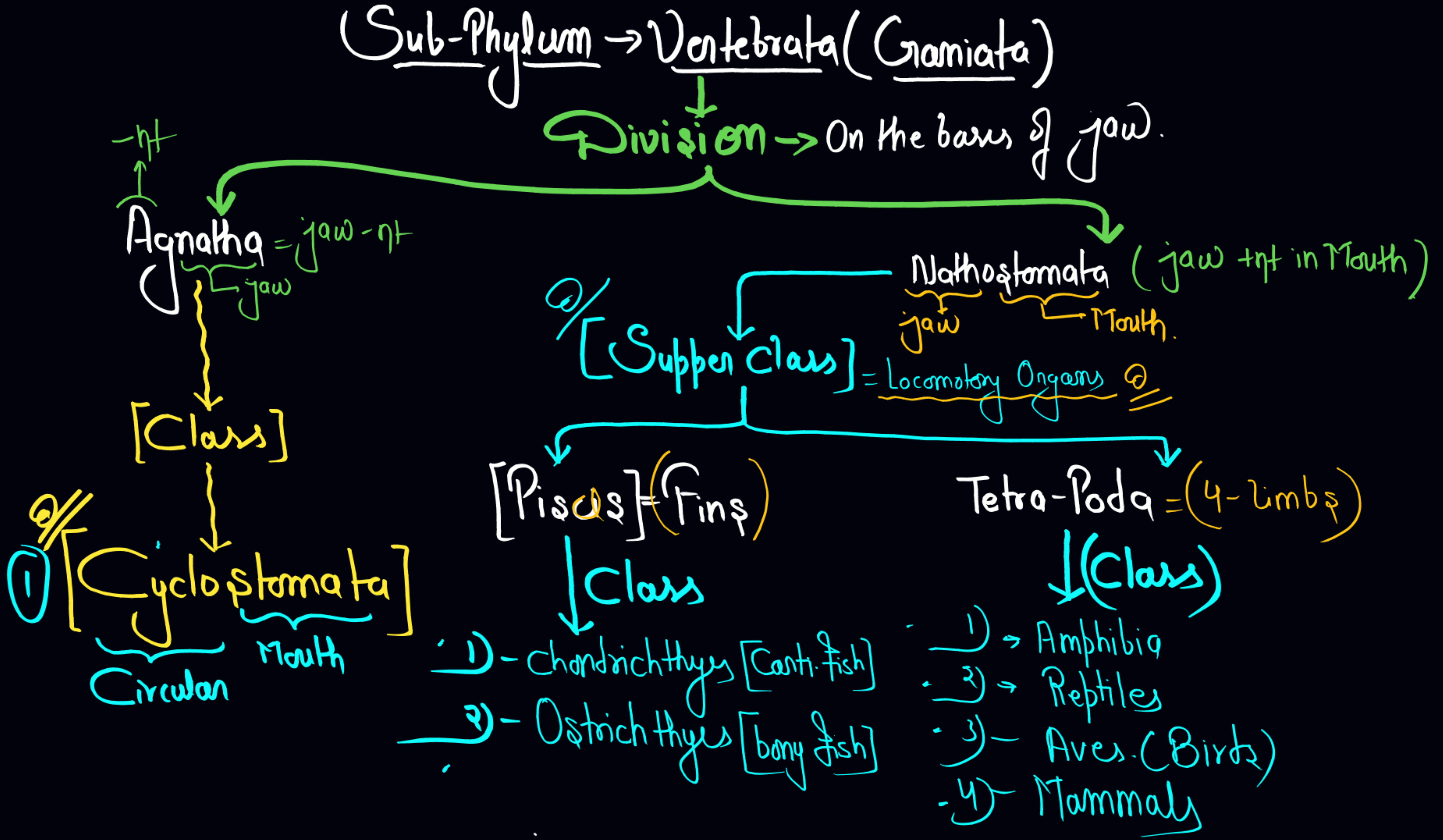


Figure 4.17 Ascidia



(Sub-Phylum → Vertebrata (Craniata)
Division → On the basis of jaw.
-nt
Agnatha = jaw - nt
jaw
[Class]
① [Cyclostomata]
Circular
Mouth
Nathostomata (jaw +nt in Mouth)
jaw
Mouth.
[Supper Class] = Locomotory Organs
[Piscas] = (Fins)
Class
1) - Chondrichthyes [Canti. fish]
2) - Ostrichthyes [bony fish]
Tetra-Poda = (4- Limbs)
(Class)
1) → Amphibia
2) → Reptiles
3) - Aves. (Birds)
4) - Mammals

Class – Cyclostomata

Circular Mouth

1. All living members of the class Cyclostomata are ectoparasites on some fishes. → Bony fish.
2. They have an elongated body bearing 6-15 pairs of gill slits for respiration.
3. Cyclostomes have a sucking and circular mouth without jaws.
4. Their body is devoid of scales and paired fins. ✓ → unpaired fins tnt
5. Cranium and vertebral column are cartilaginous.
6. Circulation is of closed type.

D- Scales

Mesodermal → tnt in fish

Ectodermal → tnt in —
- Reptiles
- Birds
- Some Mammals

2 - Fins

- **Paired** →
  - Pectoral fins
  - Pelvic fins

  ↓

  Fish

- **Unpaired** →
  - Dorsal
  - Ventral
  - Caudal

  ↓

  Fish + Cyclostomata





Figure 4.18 A jawless vertebrate - *Petromyzon*

NCERT

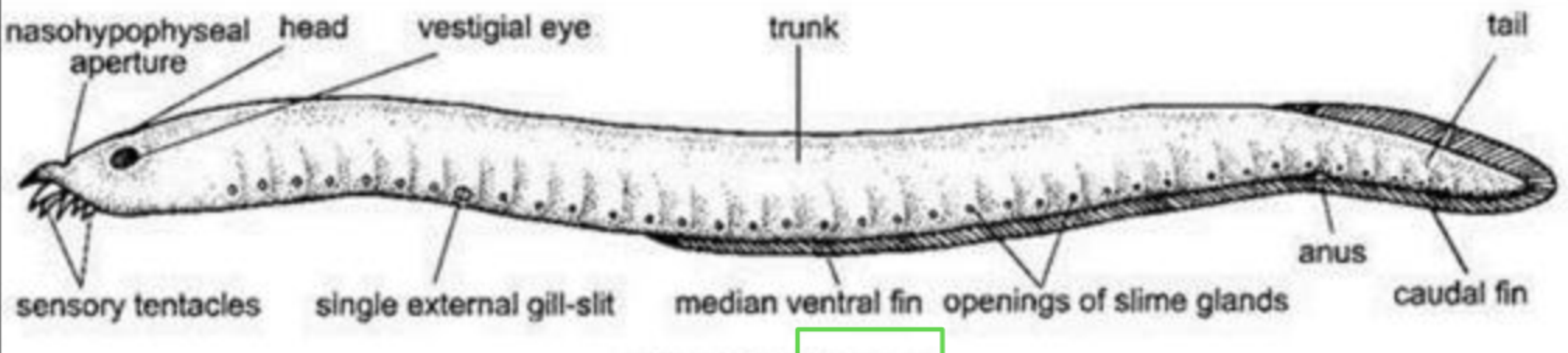
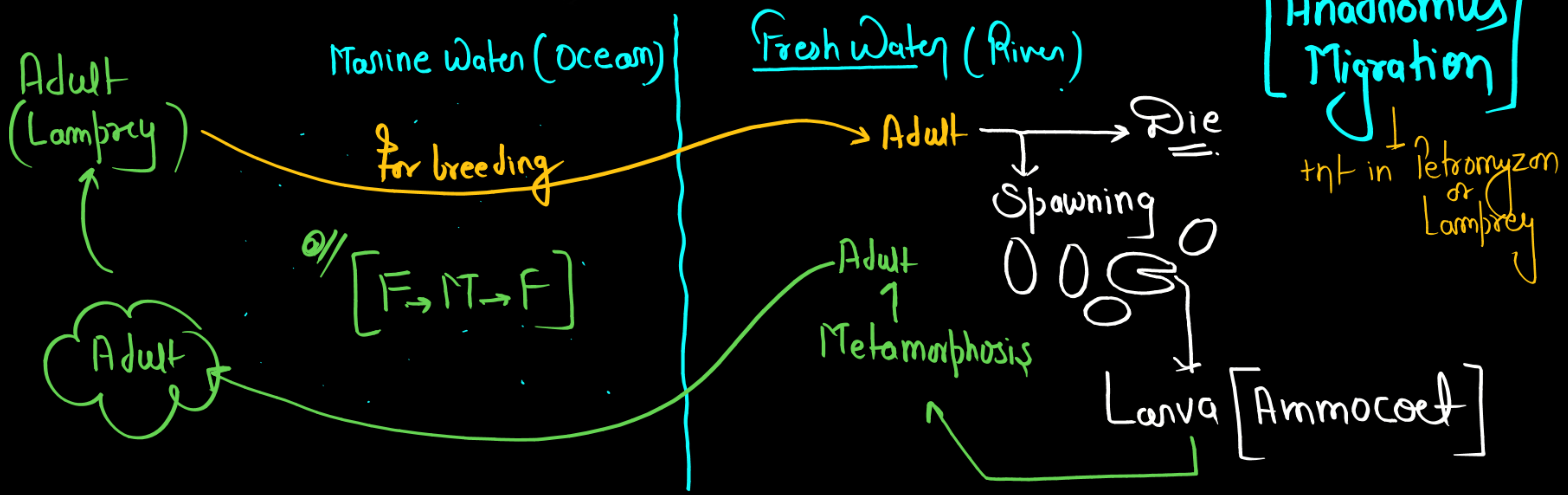


Fig. 12.1. *Myxine*.

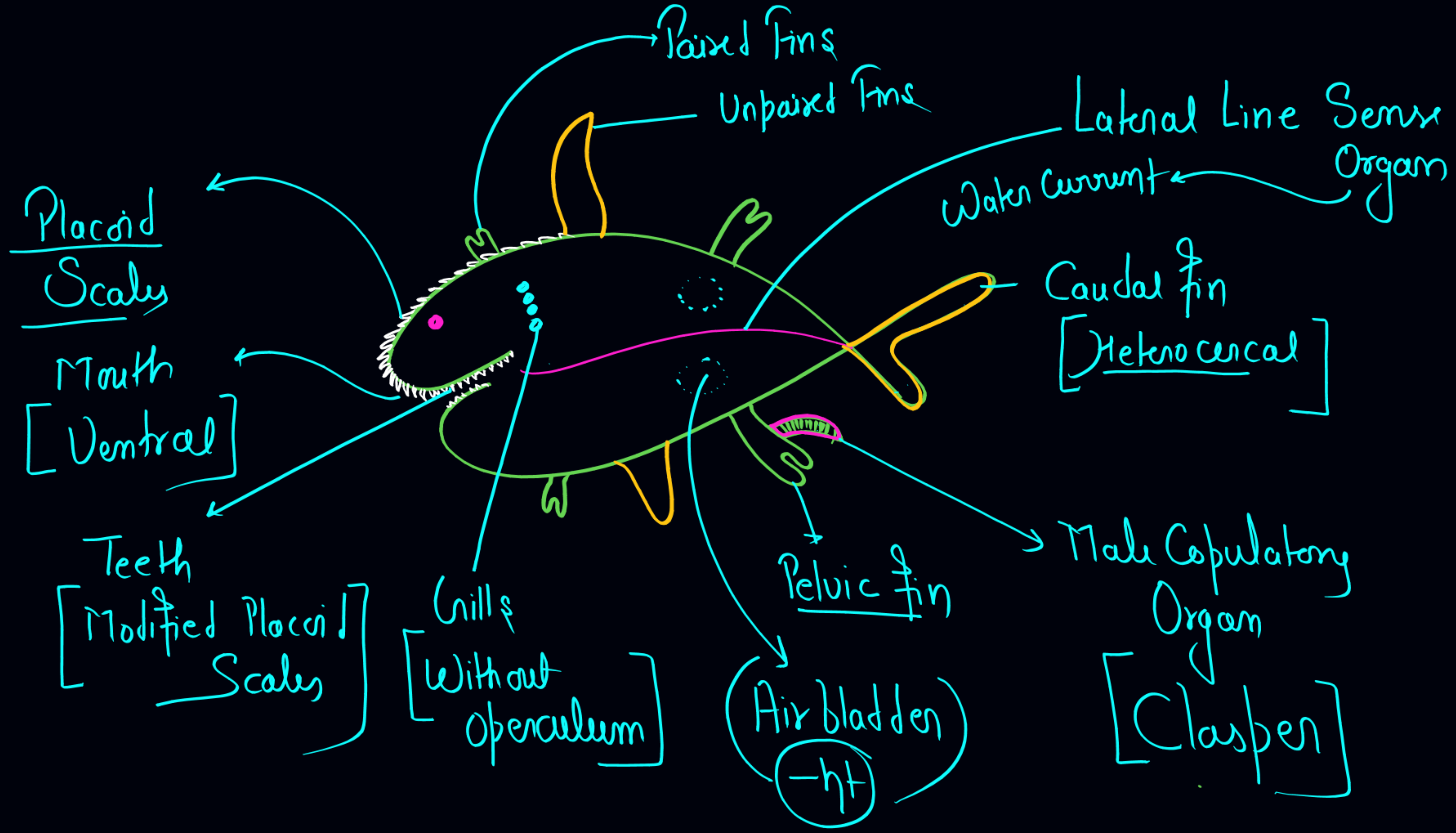
Cyclostomes are marine but migrate for spawning to fresh water.
After spawning, within a few days, they die.
Their larvae, after metamorphosis, return to the ocean.



Examples: Petromyzon (Lamprey) and Myxine (Hagfish).

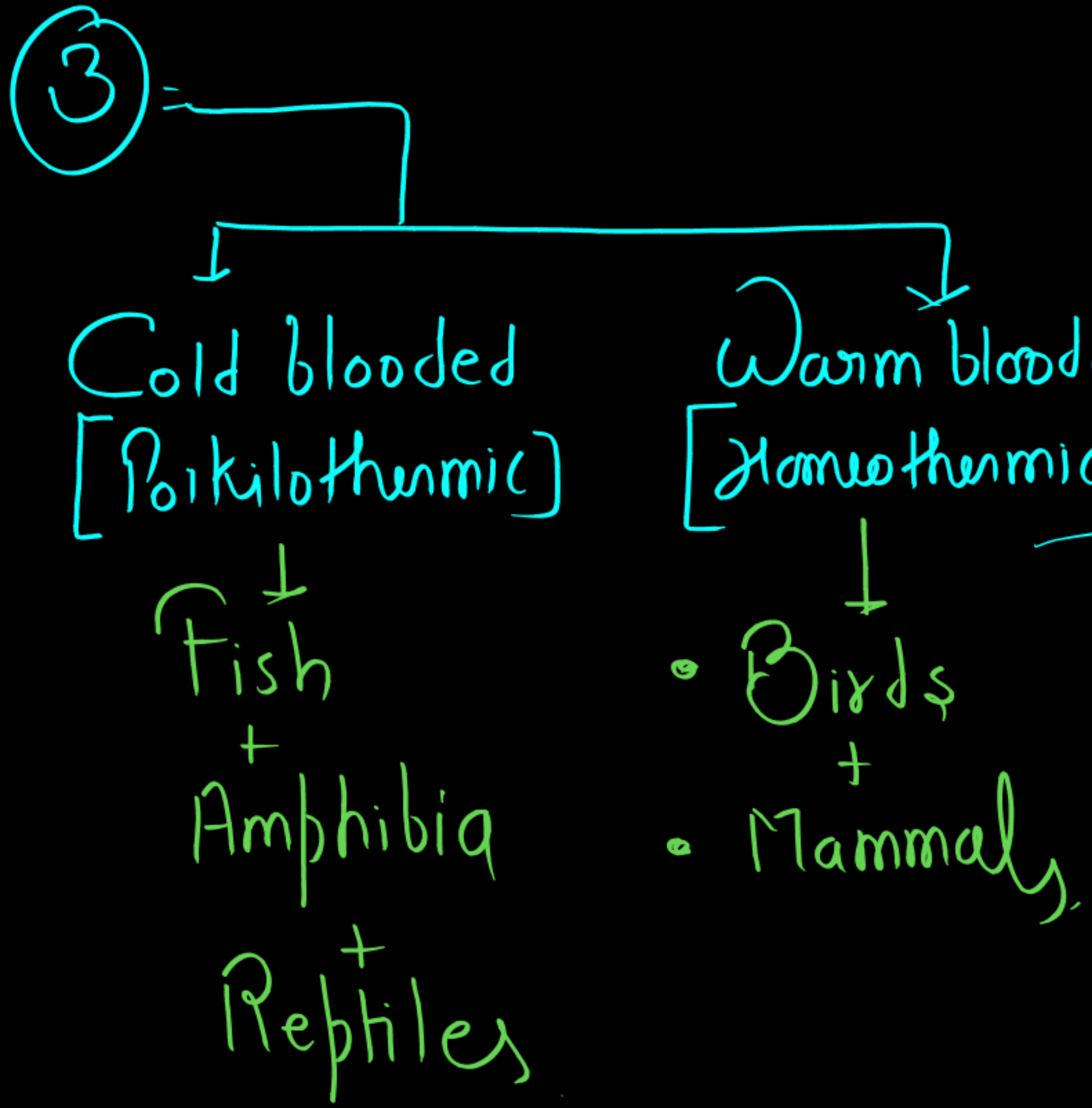
Class – Chondrichthyes

1. They are marine animals with streamlined body and have cartilaginous endoskeleton.
2. Mouth is located ventrally.
3. Notochord is persistent throughout life.
4. Gill slits are separate and without operculum (gill cover).
5. The skin is tough, containing minute placoid scales. Teeth are modified placoid scales which are backwardly directed.
6. Their jaws are very powerful.
7. These animals are predaceous.



Paired Fins
Unpaired Fins
Lateral Line Sense Organ
Water Current
Placoid Scales
Caudal fin [Heterocercal]
Mouth [Ventral]
Teeth [Modified Placoid Scales]
Gills [Without Operculum]
Air bladder (-nt)
Pelvic fin
Male Copulatory Organ [Clasper]

9. Due to the absence of air bladder, they have to swim constantly to avoid sinking.
10. Heart is two-chambered (one auricle and one ventricle).
11. Some of them have electric organs (e.g., Torpedo) and
12. some possess poison sting (e.g., Trygon).
13. They are cold-blooded (poikilothermous) animals, i.e., they lack the capacity to regulate their body temperature.



14. Sexes are separate. In males pelvic fins bear claspers. They have internal fertilisation and many of them are viviparous.

Examples: Scoliodon (Dog fish), Pristis (Saw fish), Carcharodon (Great white shark), Trygon (Sting ray).

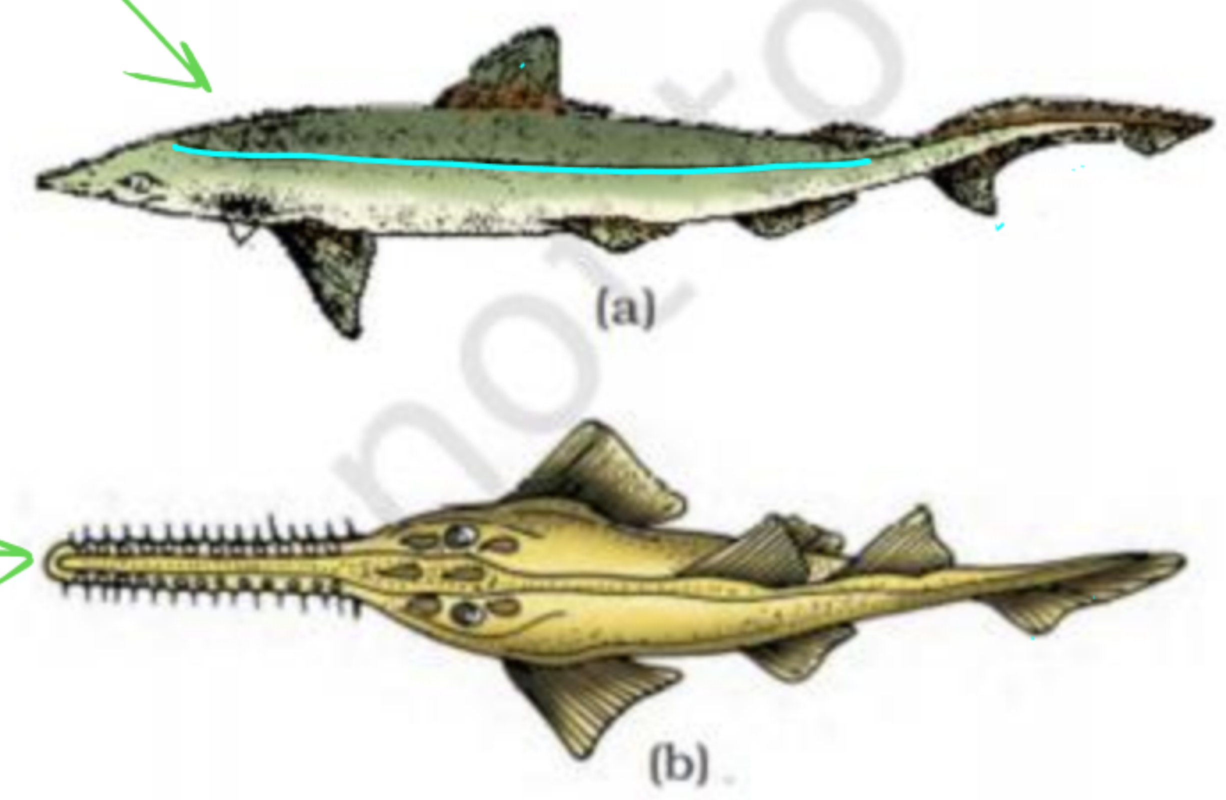
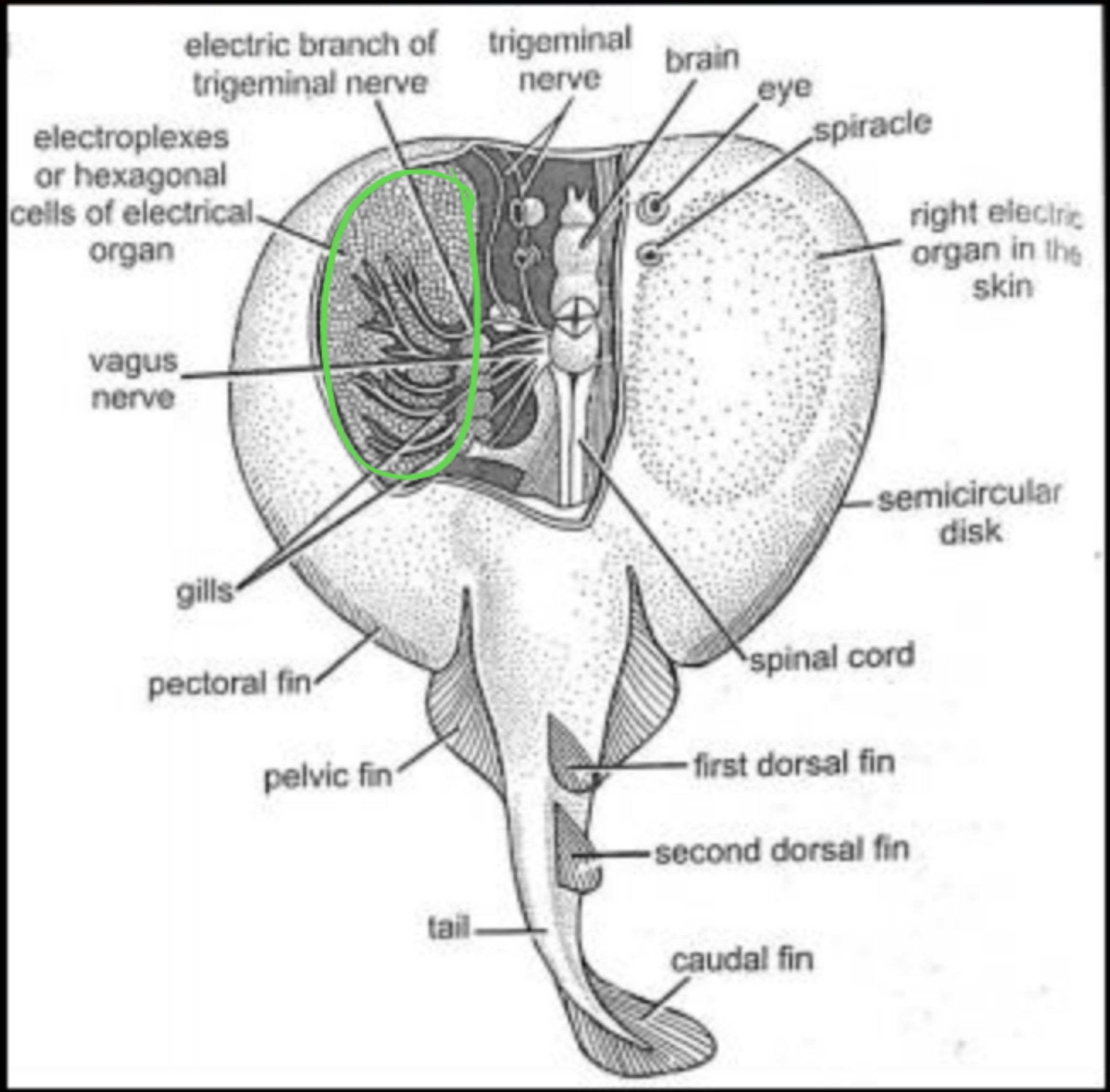


Figure 4.19 Example of Cartilaginous fishes : (a) *Scoliodon* (b) *Pristis*





electric branch of trigeminal nerve
trigeminal nerve
brain
eye
spiracle
electroplexes or hexagonal cells of electrical organ
right electric organ in the skin
vagus nerve
semicircular disk
gills
spinal cord
pectoral fin
pelvic fin
first dorsal fin
second dorsal fin
tail
caudal fin



Class – Osteichthyes

1. It includes both marine and fresh water fishes with bony endoskeleton. Their body is streamlined.
2. Mouth is mostly terminal.
3. They have four pairs of gills which are covered by an operculum on each side.
4. Skin is covered with cycloid/ctenoid scales.
5. Air bladder is present which regulates buoyancy.
6. Heart is two chambered (one auricle and one ventricle).
7. They are cold-blooded animals.

8. Sexes are separate. Fertilisation is usually external.
9. They are mostly oviparous and development is direct.

Examples:

Marine – Exocoetus (Flying fish), Hippocampus (Sea horse);

Freshwater – Labeo (Rohu), Catla (Katla), Clarias (Magur); Aquarium – Betta (Fighting fish), Pterophyllum (Angel fish)



Figure 4.20 Examples of Bony fishes : (a) *Hippocampus* (b) *Catla*

THANK YOU !!

MANTHAN NEET

ANIMAL KINGDOM

LECTURE - 8

ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

- ❑ Phylum Chordata

Class – Osteichthyes



1. It includes both marine and fresh water fishes with bony endoskeleton. Their body is streamlined.
2. Mouth is mostly terminal.
3. They have four pairs of gills which are covered by an operculum on each side.
4. Skin is covered with cycloid/ctenoid scales.
5. Air bladder is present which regulates buoyancy.
6. Heart is two chambered (one auricle and one ventricle).
7. They are cold-blooded animals.

8. Sexes are separate. Fertilisation is usually external.

9. They are mostly oviparous and development is direct.

Examples:

Marine – Exocoetus (Flying fish), Hippocampus (Sea horse); = ♂ Show Parental Care

Freshwater – Labeo (Rohu), Catla (Katla), Clarias (Magur); Aquarium – Betta (Fighting fish), Pterophyllum (Angel fish)

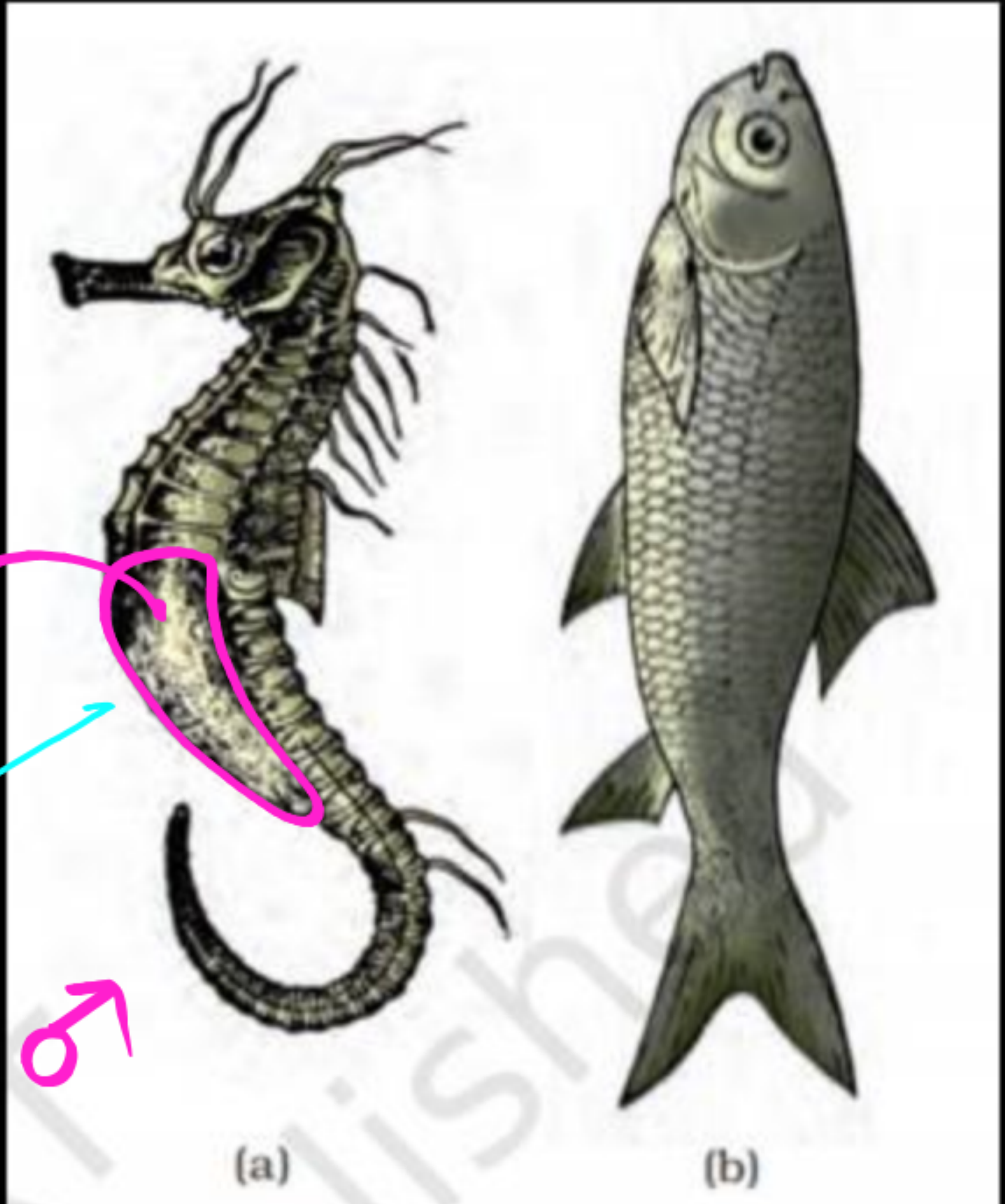
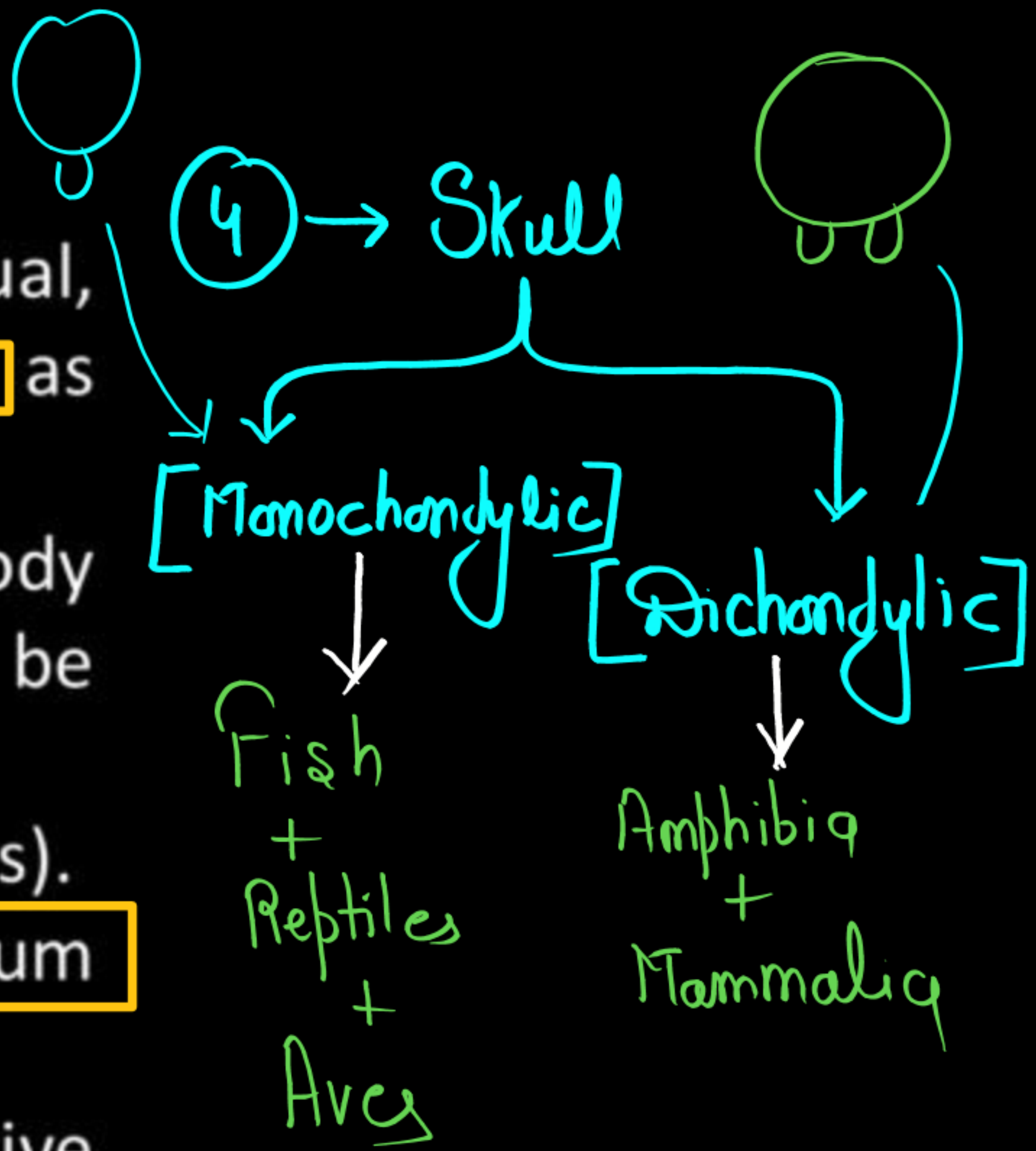


Figure 4.20 Examples of Bony fishes : (a) *Hippocampus* (b) *Catla*

Class – Amphibia

1. As the name indicates (Gr., Amphi : dual, bios, life), amphibians can live in aquatic as well as terrestrial habitats.
2. Most of them have two pairs of limbs. Body is divisible into head and trunk. Tail may be present in some.
3. The amphibian skin is moist (without scales).
4. The eyes have eyelids. A tympanum represents the ear.
5. Alimentary canal, urinary and reproductive tracts open into a common chamber called cloaca which opens to the exterior.



- Respiration is by gills, lungs and through skin.
- The heart is three chambered (two auricles and one ventricle).
- These are cold-blooded animals.
- Sexes are separate. Fertilisation is external. They are oviparous and development is indirect.

↳ Larva +nt

(5) = Cloaca [Excreta + genitalia]

-nt
- Bony fish
- Mostly Mammals

+nt
- Cartilagenous Fish.
- Amphibia
- Birds
- Some Mammals

6)- Ear →

Fish → only Internal Ear (3- Semicircular Canal)

Amphibia → Internal Ear (3-Semi.) + Middle Ear
- → one Ear Ossicle
- → Tympanum

Reptiles → ″ ″ + ″ ″

Birds → ″ ″ + ″ ″ + External Ear opening

Mammals → ″ ″ + ″ ″ [3- Ear Ossicles] + Pinna tnt in Ex. Ear

Examples:

Bufo (Toad), Rana (Frog), Hyla (Tree frog), Salamandra (Salamander), Ichthyophis (Limbless amphibia).

Show Parental Care



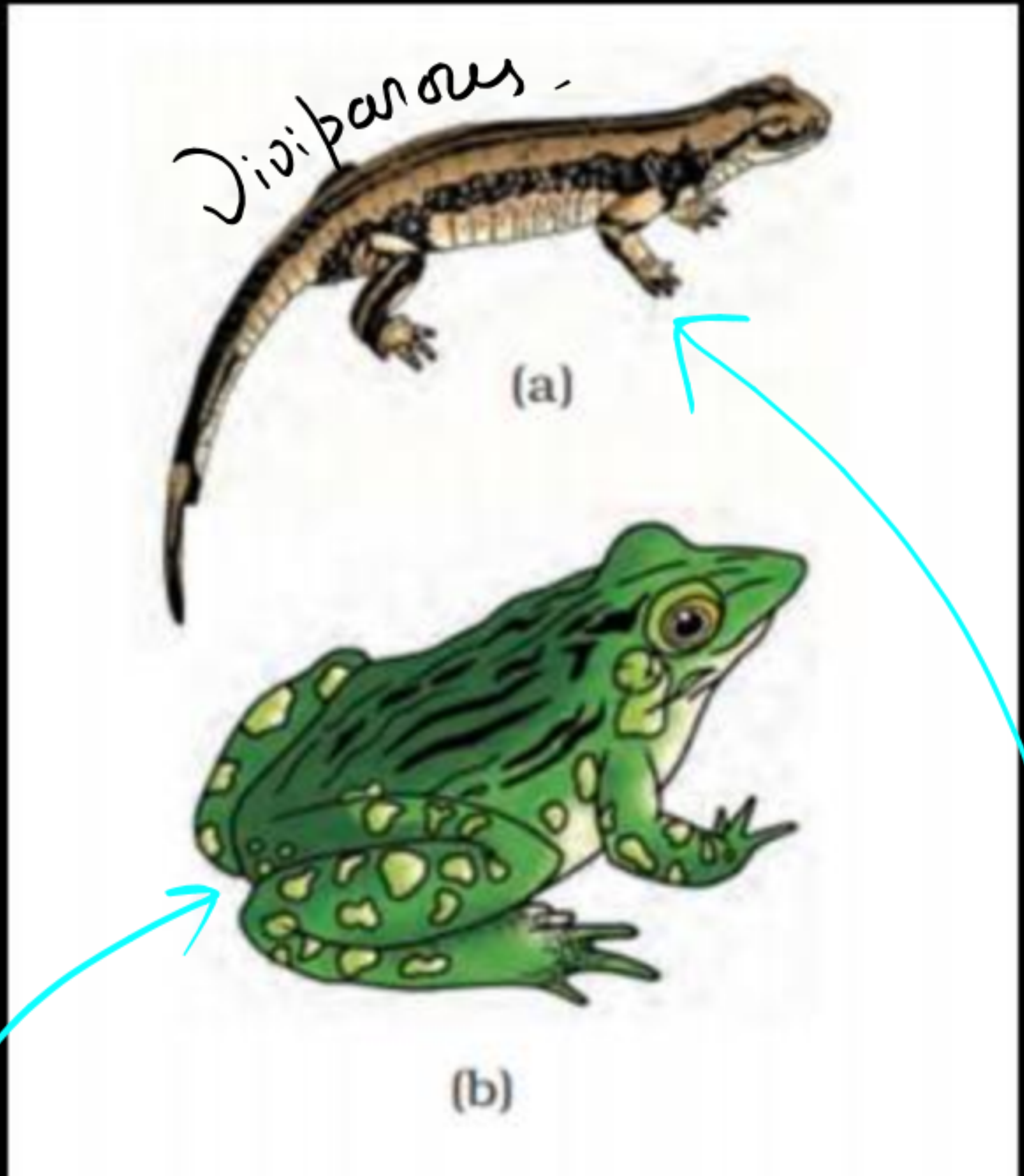


Figure 4.21 Examples of Amphibia : (a) *Salamandra* (b) *Rana*

Class – Reptilia

1. The class name refers to their creeping or crawling mode of locomotion (Latin, repere or reptum, to creep or crawl).
2. They are mostly terrestrial animals and their body is covered by dry and cornified skin, epidermal scales or scutes.
3. They do not have external ear openings. Tympanum represents ear.
4. Limbs, when present, are two pairs.
5. Heart is usually three-chambered, but four-chambered in crocodiles.

6. Reptiles are poikilotherms.
7. Snakes and lizards shed their scales as skin cast.
8. Sexes are separate. Fertilisation is internal. They are oviparous and development is direct.

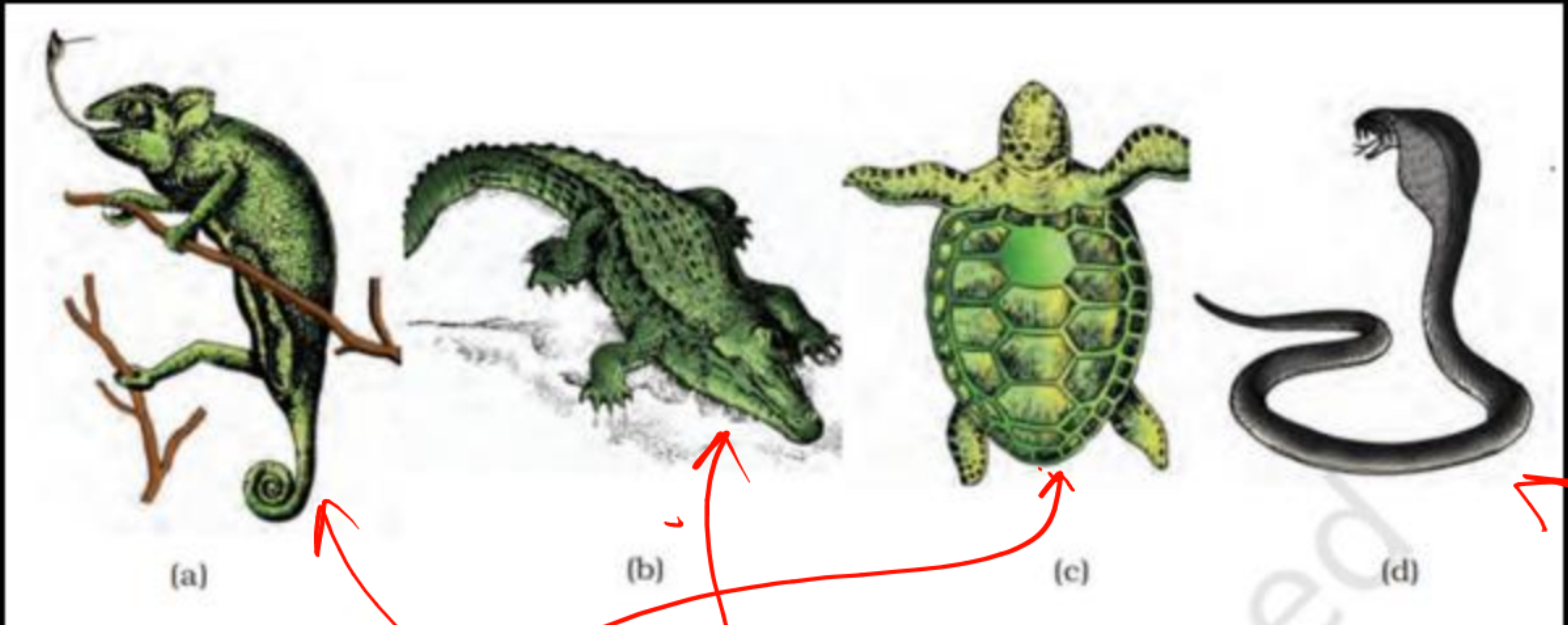
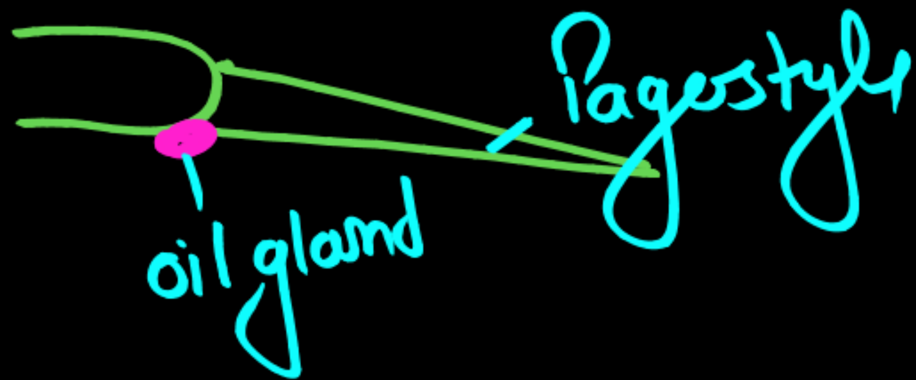


Figure 4.22 Reptiles: (a) *Chameleon* (b) *Crocodilus* (c) *Chelone* (d) *Naja*

Examples: Chelone (Turtle), Testudo (Tortoise), Chameleon (Tree lizard), Calotes (Garden lizard), Crocodilus (Crocodile), Alligator (Alligator). Hemidactylus (Wall lizard). Poisonous snakes – Naja (Cobra), Bangarus (Krait), Vipera (Viper)

Class – Aves

1. The characteristic features of Aves (birds) are the presence of feathers and most of them can fly except flightless birds (e.g., Ostrich). — Urinary bladder +nt
2. They possess beak. = Teeth -nt
3. The forelimbs are modified into wings. The hind limbs generally have scales and are modified for walking, swimming or clasping the tree branches.
4. Skin is dry without glands except the oil gland at the base of the tail.



Flightless birds
+
Kiwi, Emu, Cassowary

↓

Keel
oil glands
Pagostyle
Syrinx

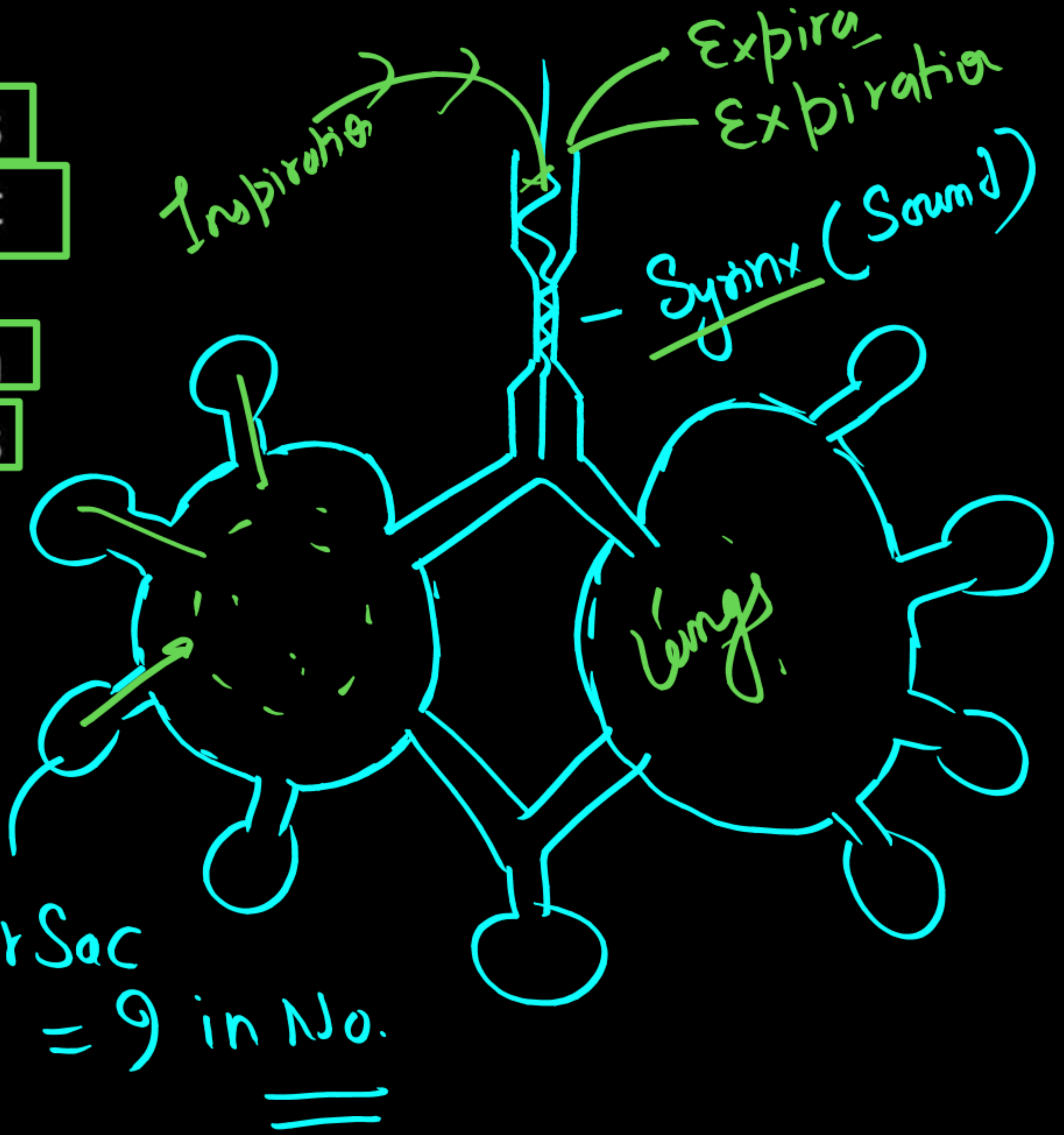
} -nt

5. Endoskeleton is fully ossified (bony) and the long bones are hollow with air cavities (pneumatic).
6. The digestive tract of birds has additional chambers, the crop and gizzard.
7. Heart is completely four chambered.
8. They are warm-blooded (homoiothermous) animals, i.e., they are able to maintain a constant body temperature.

9. Respiration is by lungs. Air sacs connected to lungs supplement respiration.

10. Sexes are separate. Fertilisation is internal. They are oviparous and development is direct.

Note - Pectin gland (Combe like)
+nt in Eyes
↓
Provide Nutrition



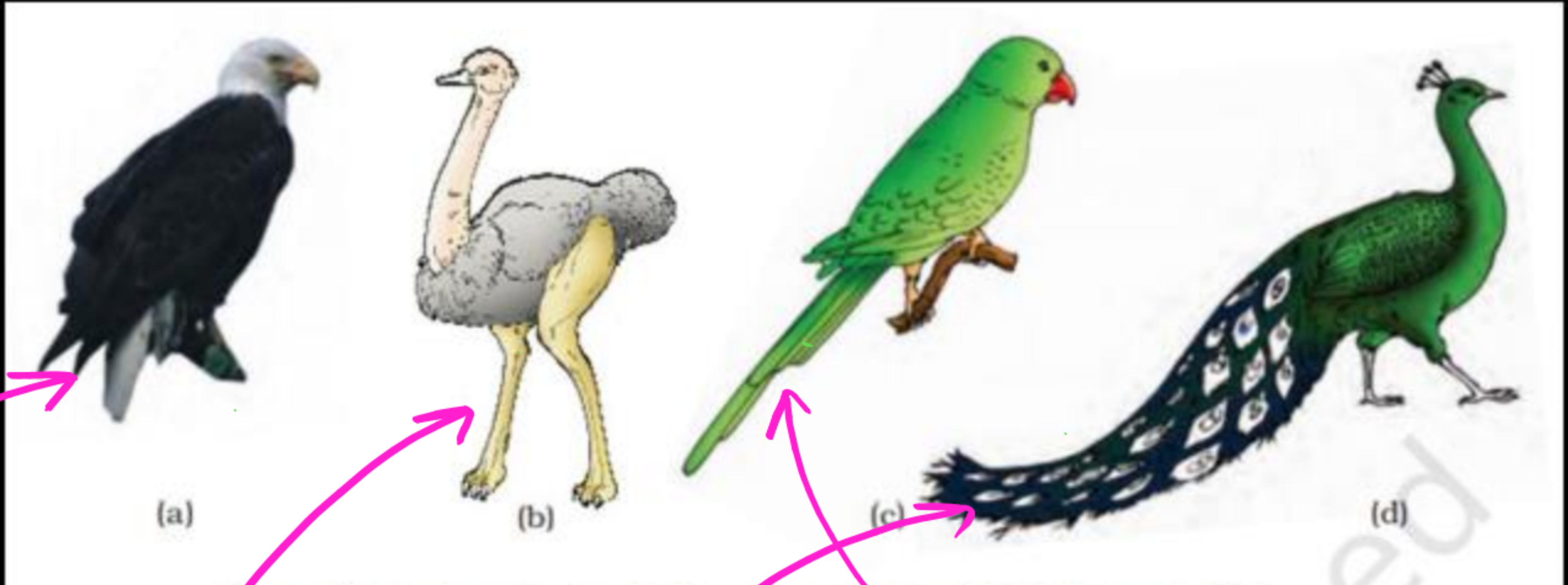


Figure 4.23 Some birds : (a) *Neophron* (b) *Struthio* (c) *Psittacula* (d) *Pavo*

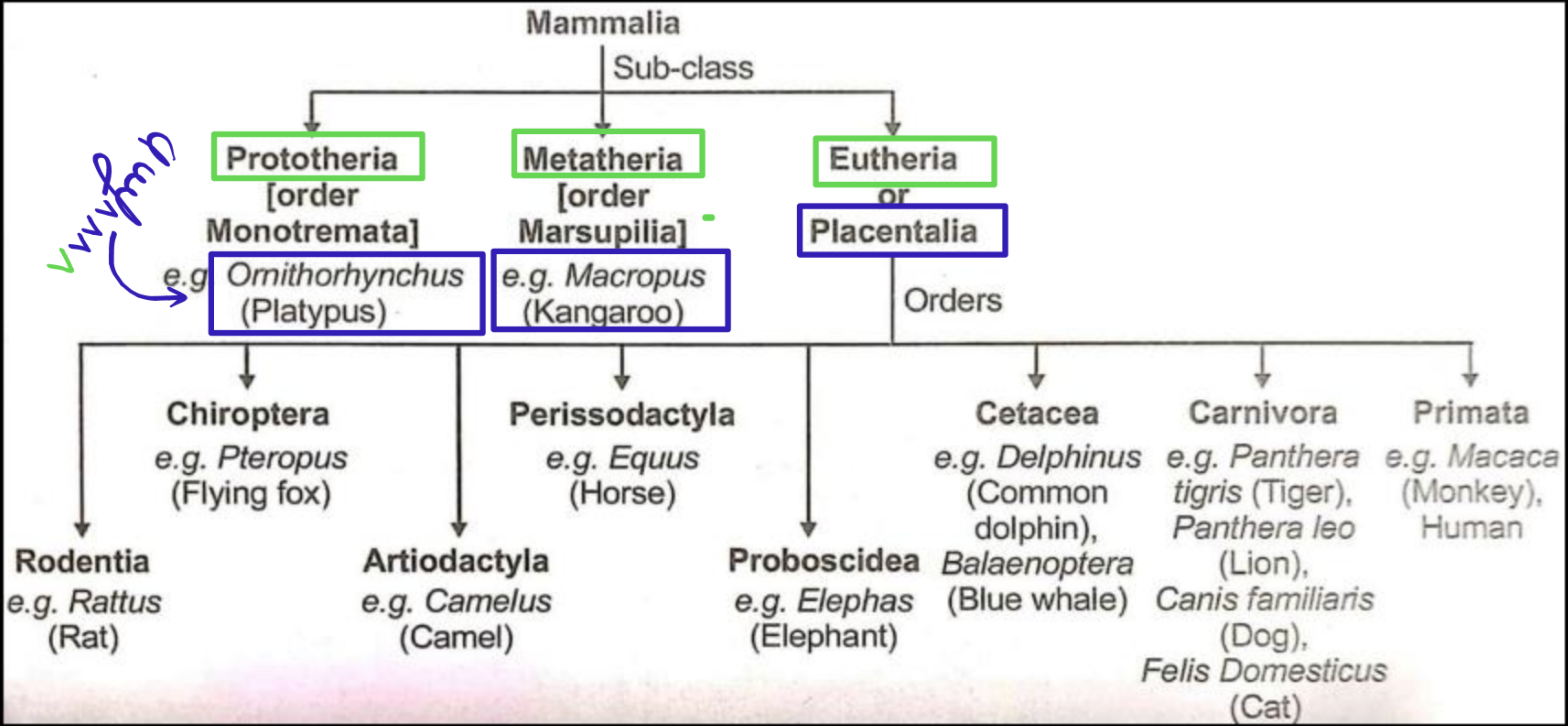
Examples : Corvus (Crow), Columba (Pigeon), Psittacula (Parrot), Struthio (Ostrich), Pavo (Peacock), Aptenodytes (Penguin), Neophron (Vulture).

Class – Mammalia

1. They are found in a variety of habitats – polar ice caps, deserts, mountains, forests, grasslands and dark caves. Some of them have adapted to fly or live in water.
2. The most unique mammalian characteristic is the presence of milk producing glands (mammary glands) by which the young ones are nourished.
3. They have two pairs of limbs, adapted for walking, running, climbing, burrowing, swimming or flying.

1) → Corpus Callosum
2) → Corpora Quadrigemina.
3) → 7 Cervical Vertebra
4) → Haversian Canals in bones
5) - Ear Pinna
6) - body Hair etc

4. The skin of mammals is unique in possessing hair.
5. External ears or pinnae are present.
6. Different types of teeth are present in the jaw.
7. Heart is four chambered.
8. They are homoiothermous.
9. Respiration is by lungs.
10. Sexes are separate and fertilisation is internal.
11. They are viviparous with few exceptions and development is direct



Mammalia
Sub-class
Prototheria [order Monotremata]
e.g. Ornithorhynchus (Platypus)
Metatheria [order Marsupilia]
e.g. Macropus (Kangaroo)
Eutheria or Placentalia
Orders
Rodentia
e.g. Rattus (Rat)
Chiroptera
e.g. Pteropus (Flying fox)
Artiodactyla
e.g. Camelus (Camel)
Perissodactyla
e.g. Equus (Horse)
Proboscidea
e.g. Elephas (Elephant)
Cetacea
e.g. Delphinus (Common dolphin), Balaenoptera (Blue whale)
Carnivora
e.g. Panthera tigris (Tiger), Panthera leo (Lion), Canis familiaris (Dog), Felis Domesticus (Cat)
Primata
e.g. Macaca (Monkey), Human

Mammary glands without Nipple.
Scrotum - nt
oviparous
Pinnna - nt

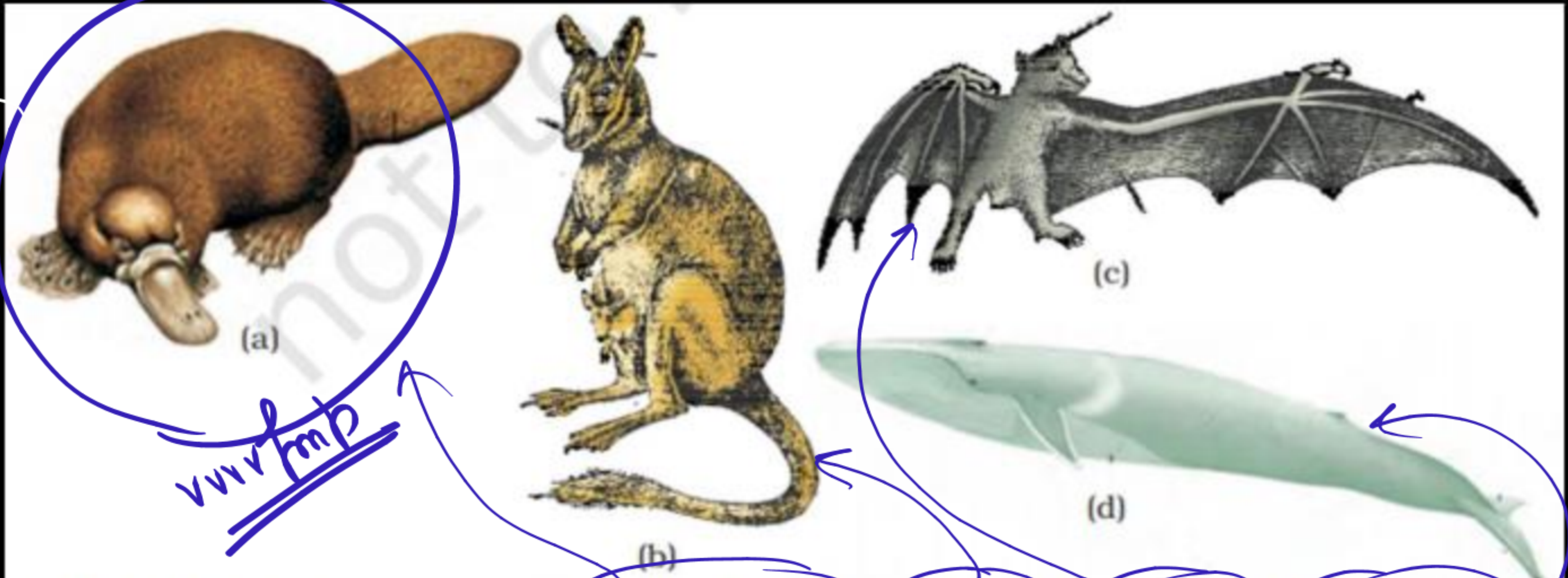


Figure 4.24 Some mammals : (a) *Ornithorhynchus* (b) *Macropus* (c) *Pteropus* (d) *Balaenoptera*

Examples: Oviparous-Ornithorhynchus (Platypus); Viviparous - Macropus (Kangaroo), Pteropus (Flying fox), Camelus (Camel), Macaca (Monkey), Rattus (Rat), Canis (Dog), Felis (Cat), Elephas (Elephant), Equus (Horse), Delphinus (Common dolphin), Balaenoptera (Blue whale), Panthera tigris (Tiger), Panthera leo (Lion).

THANK YOU !!

MANTHAN NEET

STRUCTURALORGANISATION IN ANIMALS – Animal Tissue

LECTURE - 1

ZOOLOGY



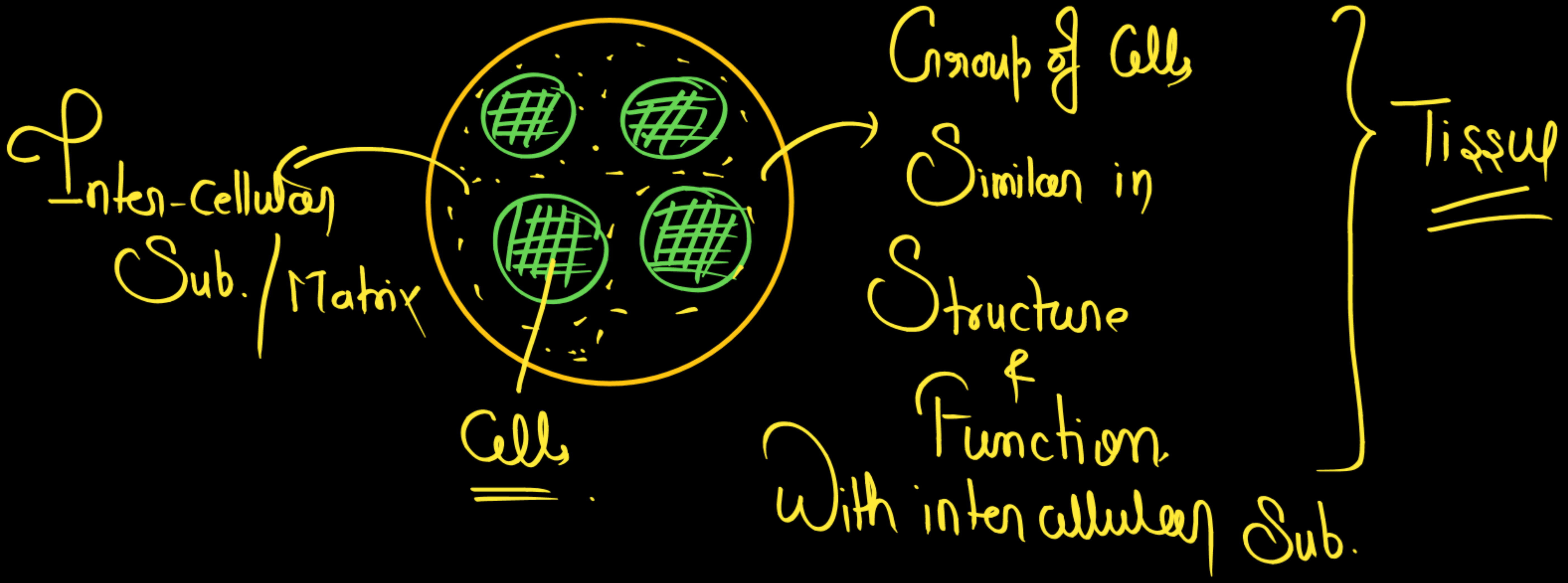
MD SIR

❑ TODAY'S GOAL -

- ❑ Epithelial Tissue

Tissue-

In multicellular animals, a group of similar cells alongwith intercellular substances perform a specific function. Such an organization is called tissue.

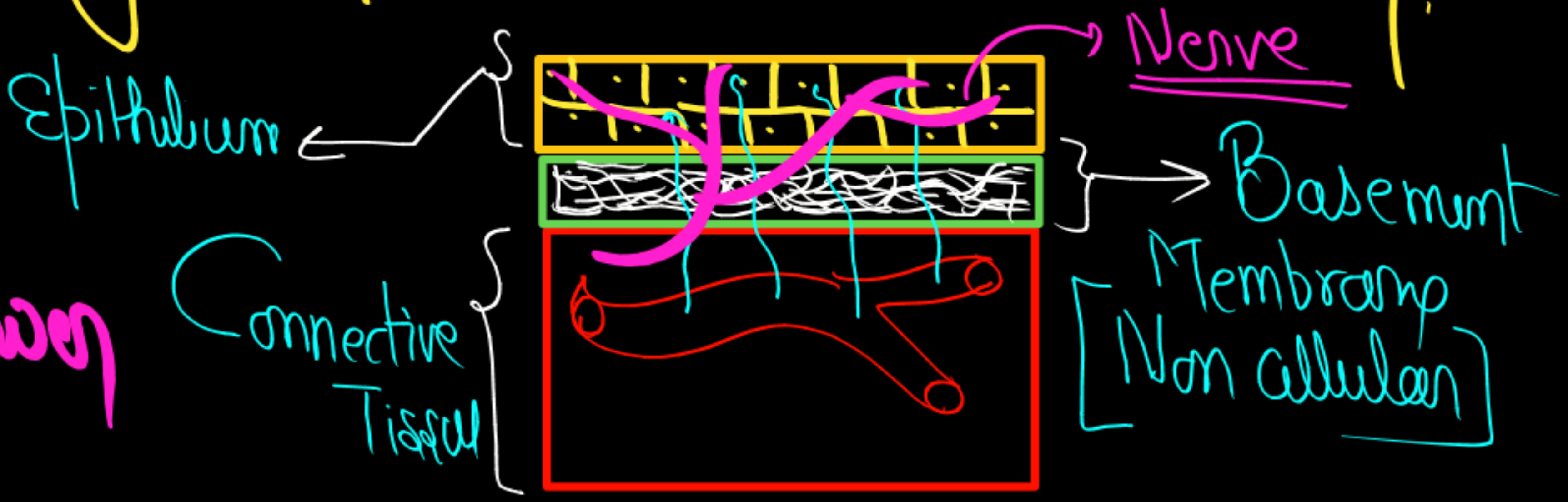


(1) Epithelial Tissue-

- This tissue has a free surface, which faces either a body fluid or the outside environment and thus provides a covering or a lining for some part of the body.
- The cells are compactly packed with little intercellular matrix

* Form → Covering of body Organ
  → Internal lining of Hollow Organs / Tract
  → Glands also form by = Epithelial Tissue < Cuboidal ①, Columnar ②

• AVascular [Blood Vess. -nt]
• High Regeneration power



Types of Epithelial Tissue -

Simple Epi. Tissue

[Single layer]

- +nt around body Organs
- +nt in Ducts & Tubules

Diffusion, Absorption, Secretion, Filtration etc.

Compound Epi. Tissue

[Multilayer]

Protection against Chemical & Mechanical Stresses.

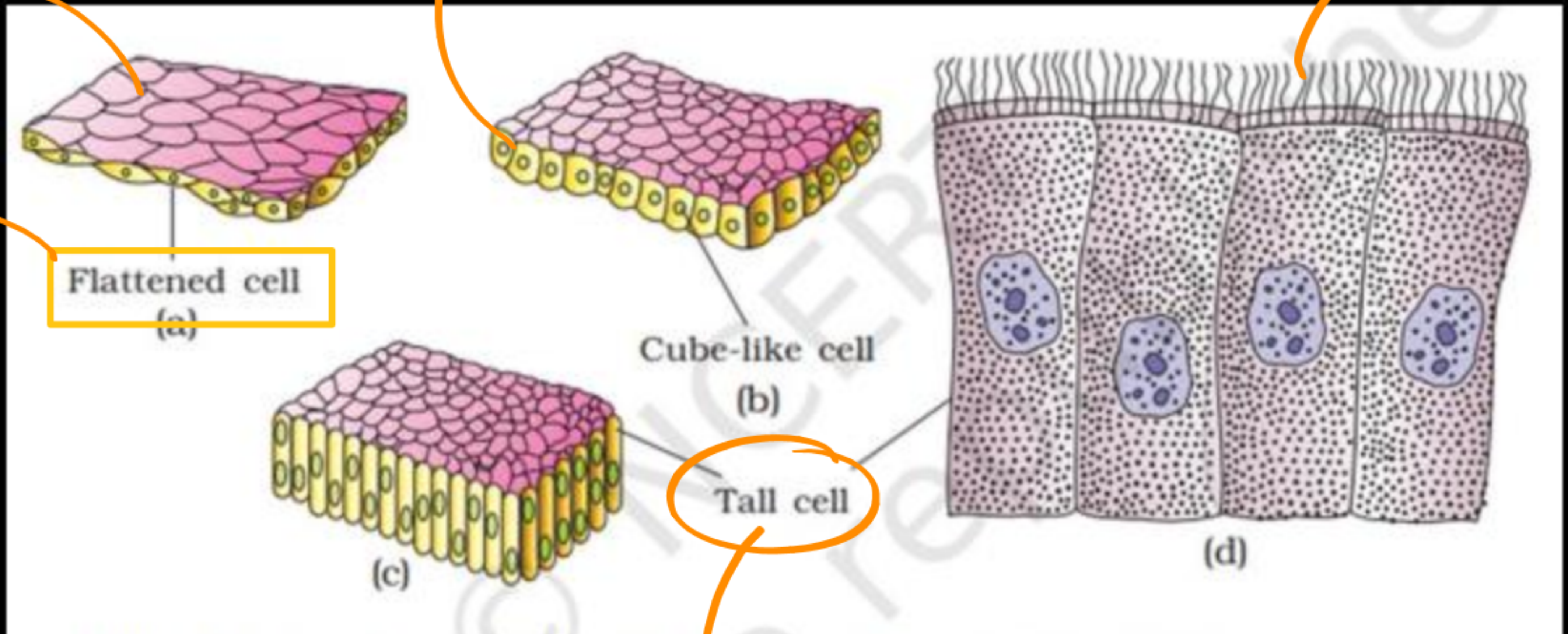


Figure 7.1 Simple epithelium: (a) Squamous (b) Cuboidal (c) Columnar (d) Columnar cells bearing cilia

Simple Squamous

(Tile like)

↓

Pavement Epithelial

Simple Cuboidal

Simple Columnar

Cilia

↓

Ciliated Columnar

(A) Simple Epithelial Tissue-

1- Simple Squamous Epi. Tissue (Pavement) → Flattend Tile like.

→ [Diffusion & Filtration] @

eg →
- → Alveoli of lungs
- → B.C. & ↓ or Thin L.H.
- → Capillary of Blood & lymph Vessels or [Endothelium]
- → Mesothelium → Internal lining of body Cavity →
  - Pericardial = Heart
  - Pleural = lungs
  - Visceral Cavity = body Organ

2) - Simple Cuboidal Epi. Tissue → (Secretion & absorption)

[Normal Cuboidal]



eg → Germinal Epi. of Gonads.
→ Nephron → ↑ L.H, D.C.T, C.D
→ Follicles of Thyroid.
→ Small Duct of Secretory Glands



[Brush border Cuboidal]



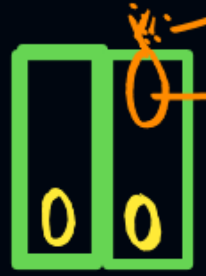
Micro Villi = ↑ - Surface area & for absorption

eg - P.C.T. of Nephron

3) - Simple Columnar Epi. Tissue (Secretion & absorption)

→ Nucleus → Oval & tnt Near the base.
→ Goblet Cells [Mucus] tnt only in Columnar

Normal Columnar



eg → Glands & Gut.

Brush Bordered Columnar



eg → Gastro-Intestinal Tract (G.I.T.) [Small Intestine]

Ciliated Columnar



- Upper Respiratory Tract
- Fallopian Tube in Female.
- Epididymis & Vas deferens & Testis.

Glandular epithelium (Glands)-

↳ Modified Epi. Tissue of - Cuboidal & Columnar

Classification →

① On the bases of No. of Cells.

- Unicellular
  - Goblet cells → Mucus
  - Paneth cells → lysozyme → Antibacterial
- Multicellular
  - eg - All Except Two

unicellular

Multicellular

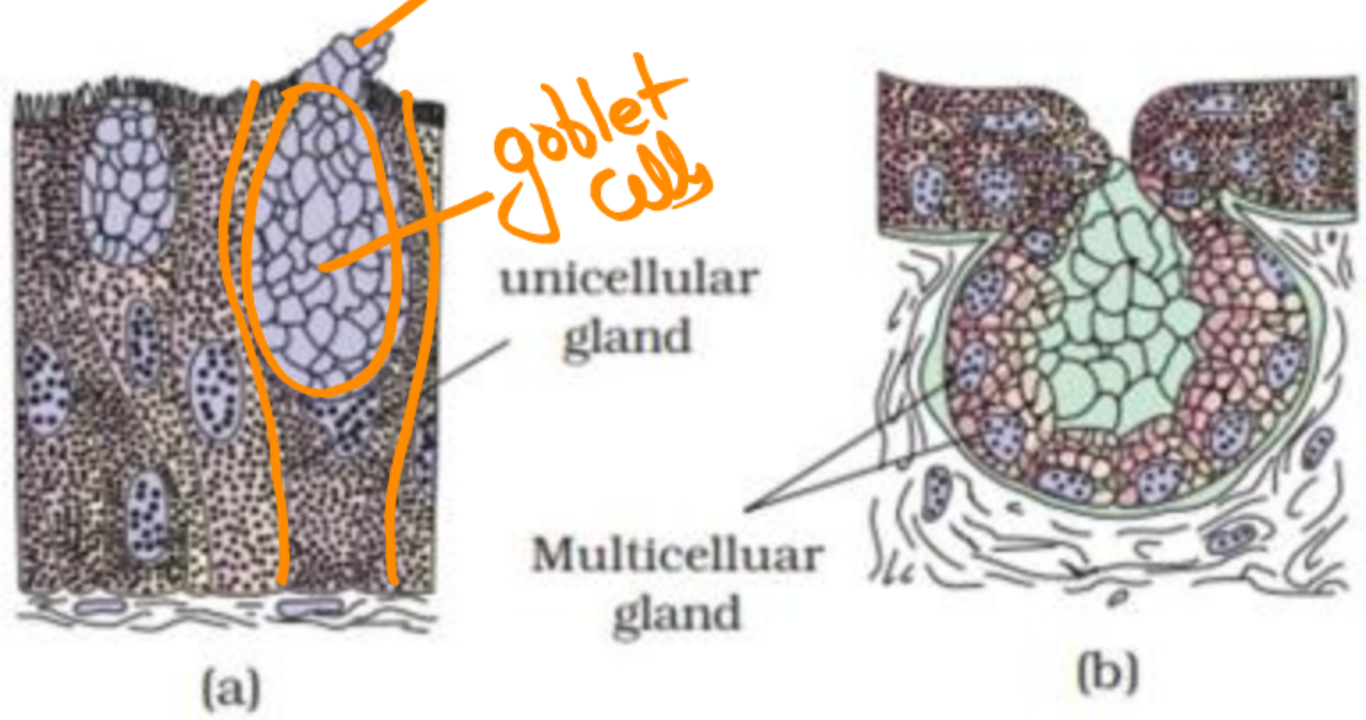


Figure 7.2 Glandular epithelium : (a) Unicellular (b) Multicellular

(2) - On the bases of Presence & absence of Duct

[Exo-crine] Duct (+nt)

eg - Release -
- Enzyme
- Mucus
- Saliva.
- Tears.
- Sweat
- Milk etc.

[Endocrine] = Duct (-nt)

eg - All Hormone Releasing glands

Heterocrine (Mixed Type)

→ Exo. & Endo.

eg - Testis ✓
- Ovary ✓
- Pancreas ✓

(B) Compound epithelium (Multilayer) = Protection

[Stretchable]
or
Transitional Epi. Tissue
or
Urothelium → tnt in Urinary System →

eg- Pelvis
Ureter
U. Bladder
Proximal Urethra

[Nonstretchable]
↓
*

Squamous

Base
[Columnar or Cuboidal]

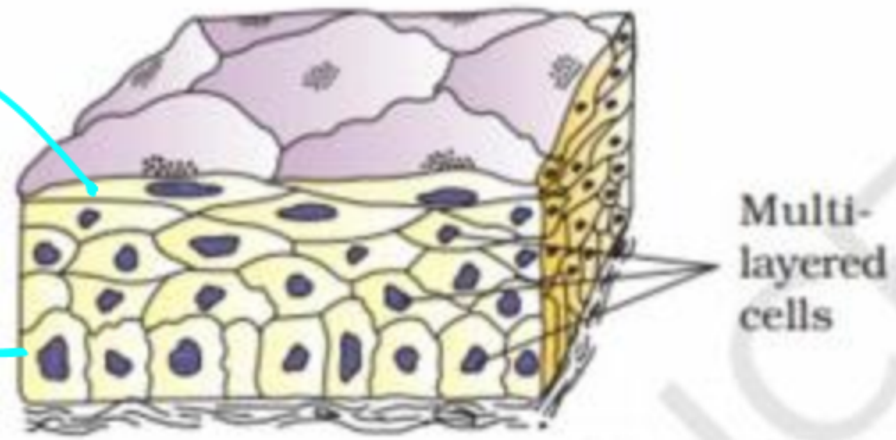
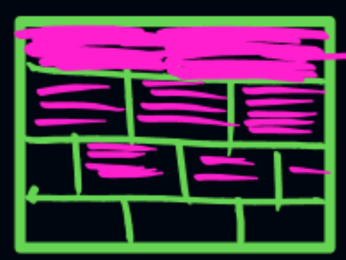


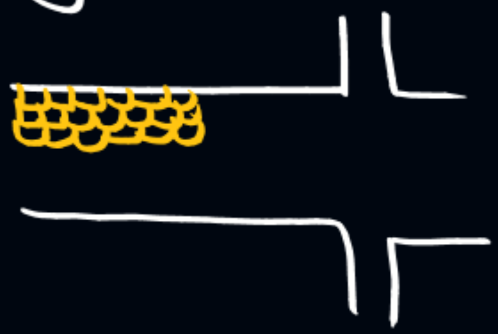
Figure 7.3 Compound epithelium

Non Stretchable (Stratified Epi. Tissue) →

- Stratified Squamous (vvImp)
  - Keratinized

    eg → Skin
    - Nails
    - Hair.
  - Nonkeratinized
    - Oral cavity
    - Pharynx
    - Oesophagus.
    - Anal Canal.
    - Vagina.
- Stra. Cuboidal → Large Duct of Secretory glands.

  
- Stra. Columnar

  eg - Conjunctiva of Eyes.

THANK YOU !!

MANTHAN NEET

STRUCTURALORGANISATION IN ANIMALS – Animal Tissue

LECTURE - 2

ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

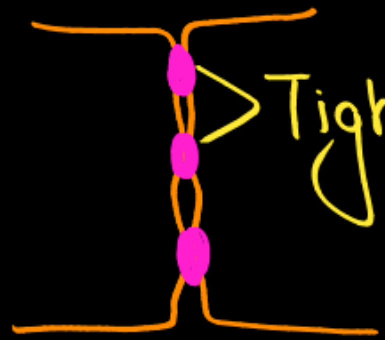
- ❑ Connective Tissue

Cell Junctions

* → Mostly junction tnt in Epithelial Tissue.

Tight junction

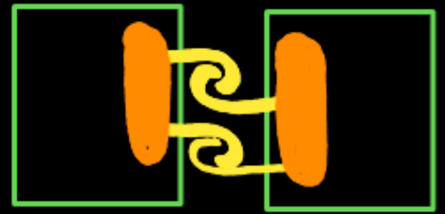
Tight junctions help to stop substances from leaking across a tissue



Adhering junction

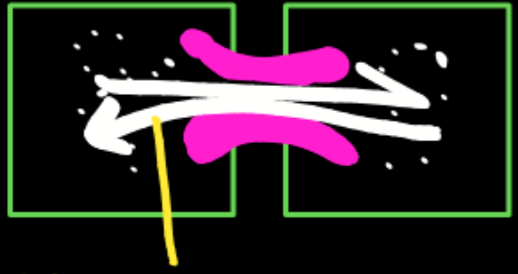
(Desmosomes or)

Adhering junctions perform cementing to keep neighbouring cells together



Gap junctions

connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small molecules and sometimes big molecules



Connective Tissue (Origin - Mesodermal)

- Connective tissues are most abundant and widely distributed in the body of complex animals.
- They are named connective tissues because of their special function of linking and supporting other tissues/organs of the body.

Composition —
- → Fibres —
  - → White = Collagen
  - → Yellow = Elastin.
  - → Reticular fibres
    - → Network
- → Matrix (Ground Sub.)
  - → Mucopolysaccharides
- → Cells. —
  - → Mesenchymal cells → Fibroblast, Osteoblast, Chondroblast etc.
  - → Fibroblast
  - → Plasma cells. (-nt in Blood)
  - → Macrophage
  - → Mast- cells etc.

{ Largest cell of Conn. Tissue
  - → Secrete Fibres



Types of Connective

- [Loose Conn. Tissue]
  - {More = Matrix, less = Fibres.}
  - 1) - Areolar Connective Tissue.
  - 2) - Adipose Conn. Tissue
- [Dense Conn. Tissue]
  - {More = Fibres, less = Matrix}
  - * Regular
    - (1) Tendon.
    - (2) Ligament.
  - * Irregular
    - White Fibrous
    - Yellow Fibrous
    - tnt in Covering.
- (Specialised - Connective Tissue)
  - X • Fluid Conn. Tissue
    - Blood
    - Lymph.
  - • Skeletal
    - Bone ✓
    - Cartilage ✓

(1) Loose Connective Tissue-

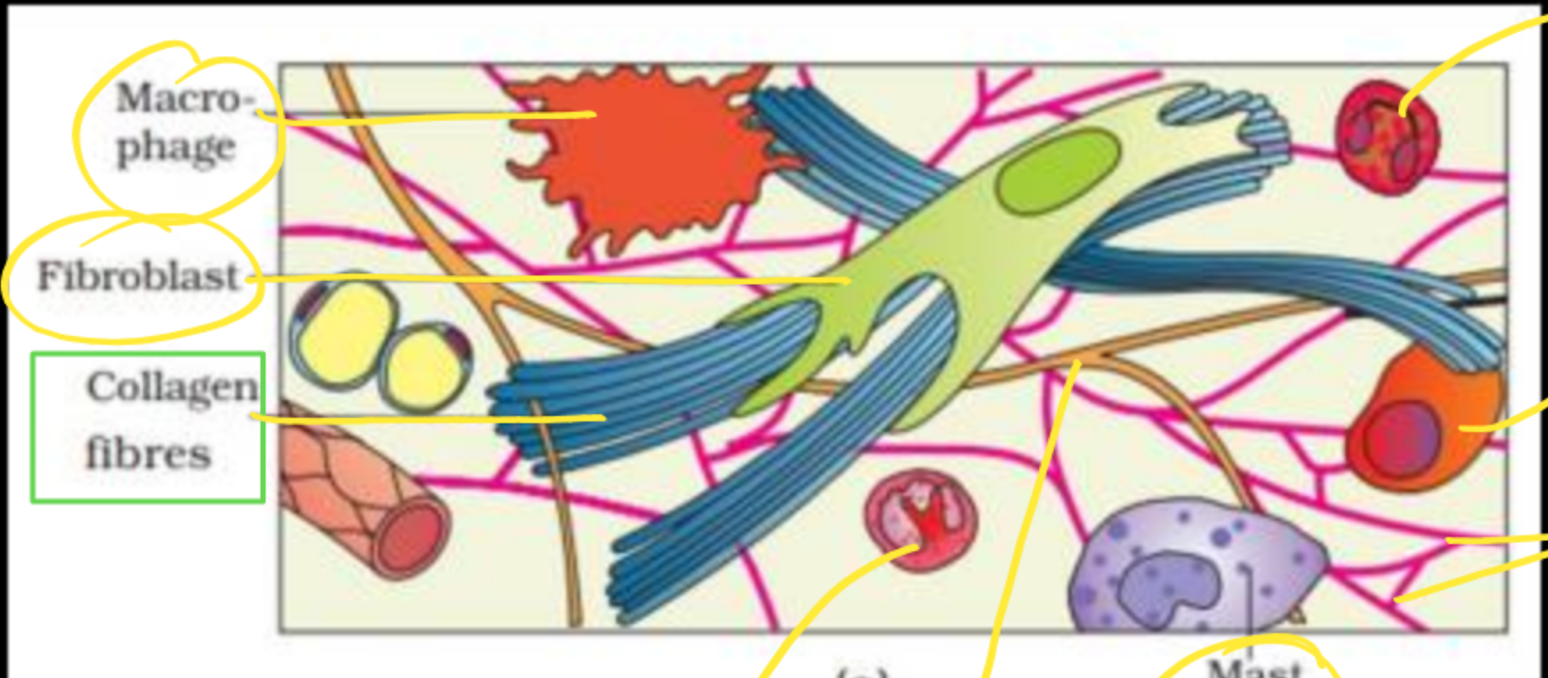
(a) Areolar Connective Tissue

* Fill the areola or Space of body.
* Prnt beneath Skin.
* Act as Supporting Framework for Epithelium.

(b) Adipose Tissue - (Fat Storing Conn. Tissue)

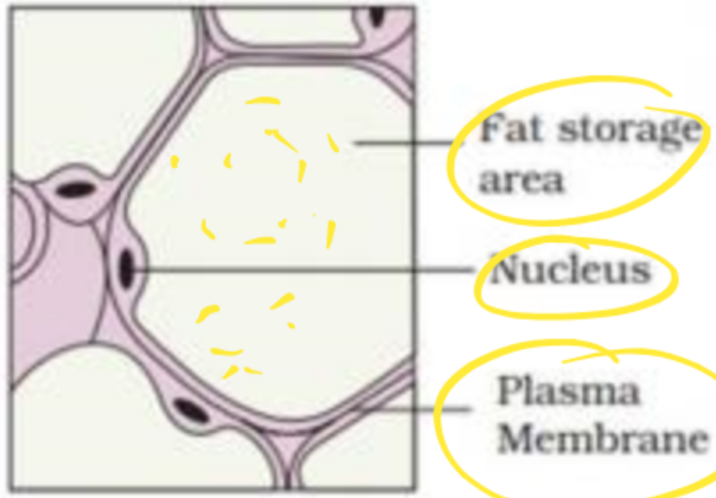
* Form by aggregation of Adipocytes [Fat Storing cells]
* Prnt beneath Skin, around body Organs.
* Act as → Insulator
  → Shock absorber

Areolar



(a)

Adipose

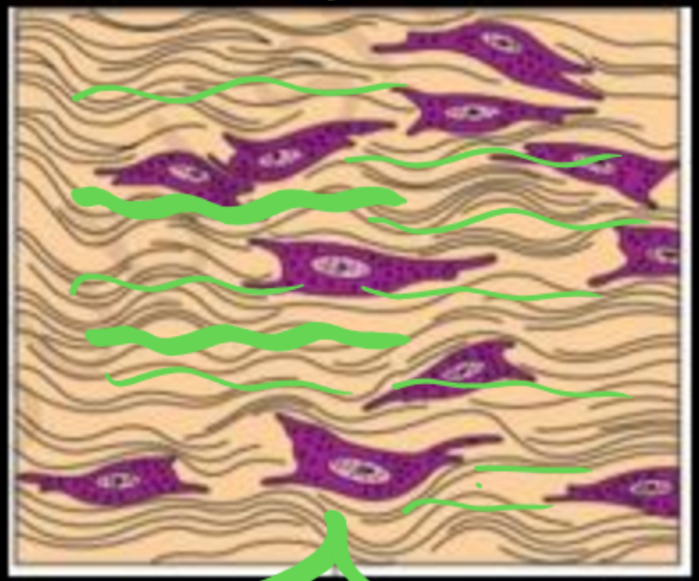


(b)

(b) Adipose tissue

(2) Dense Connective Tissues-

[Regular]



[Tendon]

- [* Form by = White Collagen]
- (join = Bone to Muscles)

[Ligament]

- [* Form by Yellow Elastin + Few Collagen]
- join = Bone to Bone

[Irregular]



→ White Fibrous or Yellow Fibrous

- Pnt in Dermis
- Pnt around Organs
  - Pericardium — Heart
  - Periosteum — bone
  - Perichondrium — Cartilage
  - Pleural etc → lungs

(3) Specialised Connective Tissue

(a) Cartilage- (Solid and Pliable)

Composition
- Fibres → Yellow - Elastic / white Collagen
- Matrix → Chondrin.
- Cells

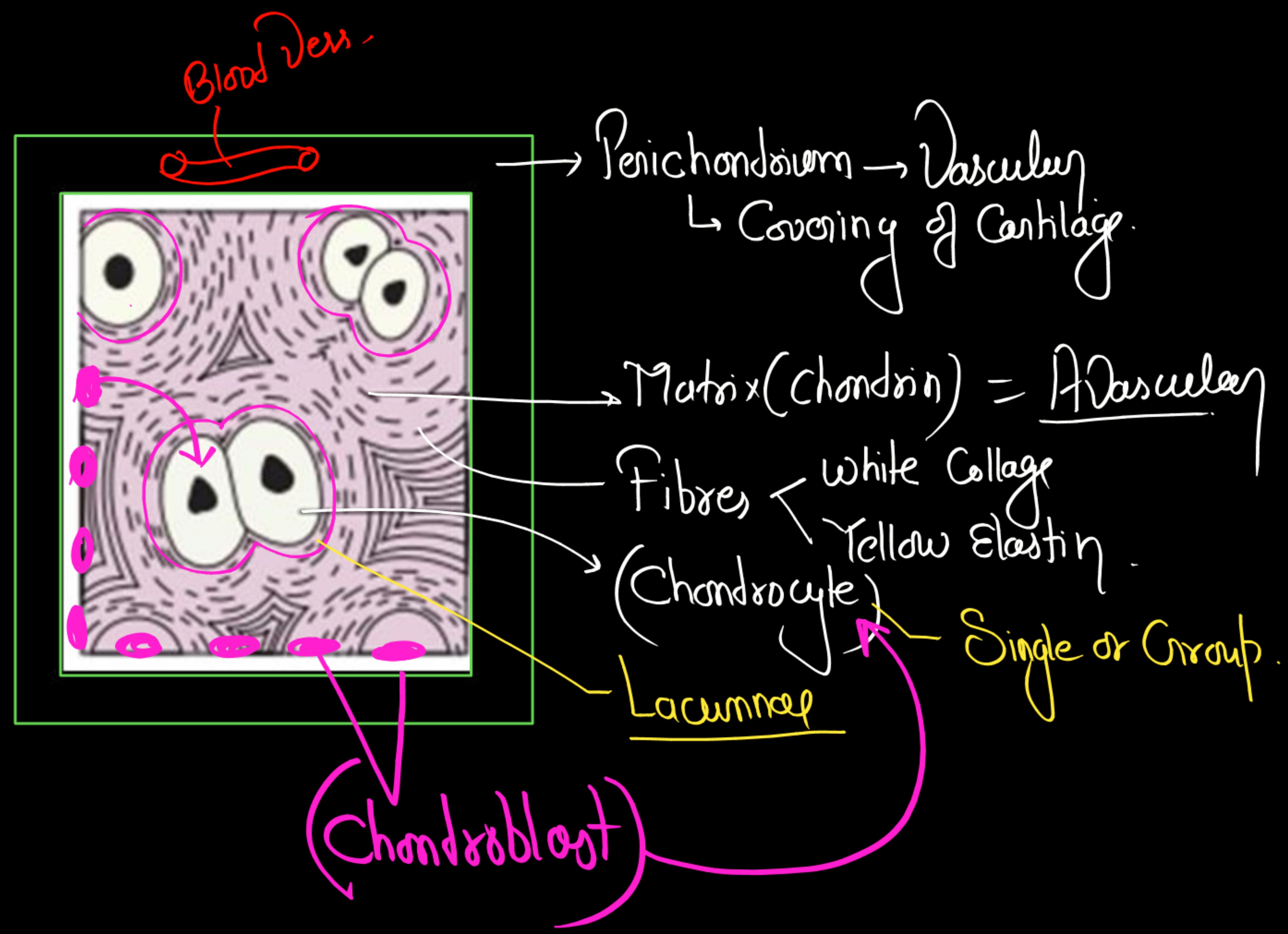
(Chondroblast)
- * Immature Dividing Cells.
- ✓ Pnt in Outer periphery

(Chondrocytes)
- Mature - Non Dividing Cells
- Pnt in Lacunae (Space) (Single or Group)

Maintain Growth of Cartilage.



(Chondroclast) or Macrophase.
- Cartilage Eating Cells
- Responsible for - Replacement of Embryonic Cartilage by bone in Adult.


Blood Vess.
Perichondrium → Vascular
↳ Covering of Cartilage.
Matrix (Chondrin) = A Vascular
Fibres
White Collage
Yellow Elastin.
(Chondrocyte)
Single or Group.
Lacunnae
(Chondroblast)

THANK YOU !!

MANTHAN NEET 1.0 & 2.0

STRUCTURALORGANISATION IN ANIMALS – Cockroach

LECTURE - 3

ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

- ❑ Types of Cartilage & Bone
- ❑ Cockroach-1



Types of Cartilage

Hyaline Cartilage
- Translucent Matrix
- Type-II thin Collagen fnt

eg →
- Septum of Nose
- Larynx
- C-Shape Hyaline of upp. Respiratory tract
- Costal (Ribs) Cartilage

Elastic Cartilage.
- Elastin fibres.

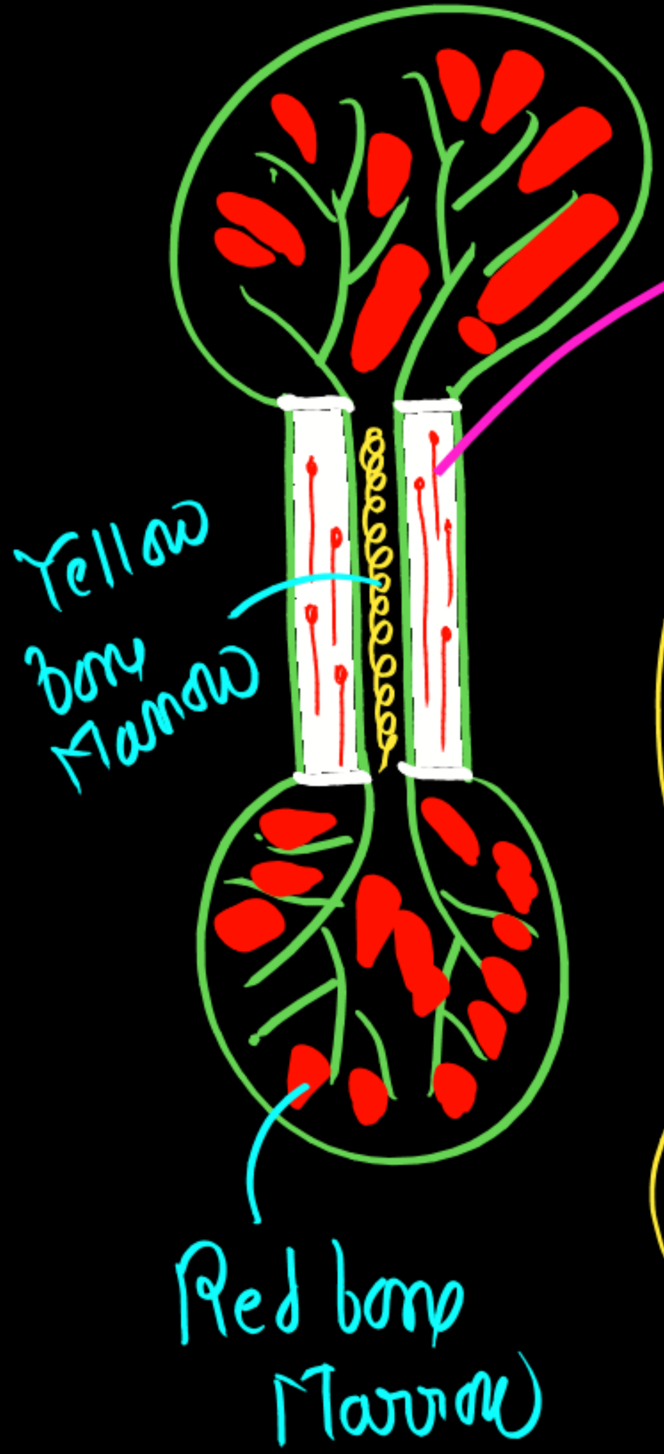
eg →
- Tip of Nose
- Epiglottis
- Pinna of Ear.
- Eustachian tube of Middle Ear.

Fibrous Cartilage.
- (Strongest)
- Thick Collagen fibres.

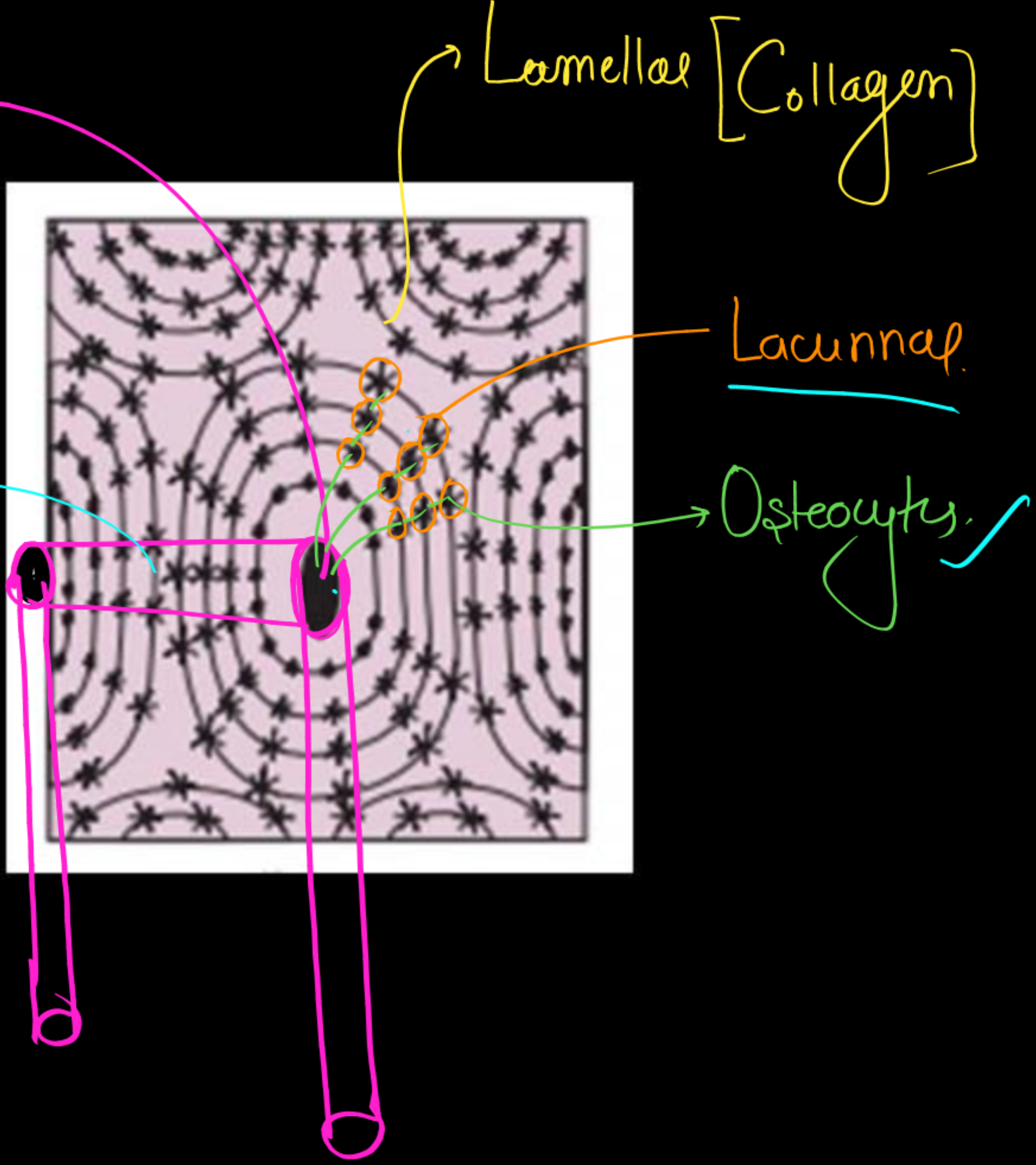
eg –
- Intervertebral Disc
- Pubic Symphysis

(b) Bone - (Hard and non pliable)

Composition
- Fibres → Collagen fibres
- Matrix
  - Organic Sub. → [30-40%]
    - Mucopolysaccharides
    - Fibres
    - Protein = Ossein etc.
  - Inorganic Sub. [60-70%]
    - Calcium Carbonate = 10%
    - Calcium Phosphate = 85%
    - Calcium Hydroxide, Ions etc. } 5%
- Cells.
  - (Osteoblast) → Prsnt in Outer & Inner periphery.
  - (Osteocyte) + [Prsnt in Lacunae] (Single lacunae Contain Single cell)
  - Osteoblast and Osteocyte → (Maintain Growth of bone)
  - (Osteoclast) + (Macrophage) → (↑ - Blood Ca^{++} level)



Longitudenal Canals
[Haversian Canals]
→ Artery, Vein, Lymph Vess. Nerve etc.
(Transverse Canals)
Valkman's Canals
(tnt in Mammals Bone)

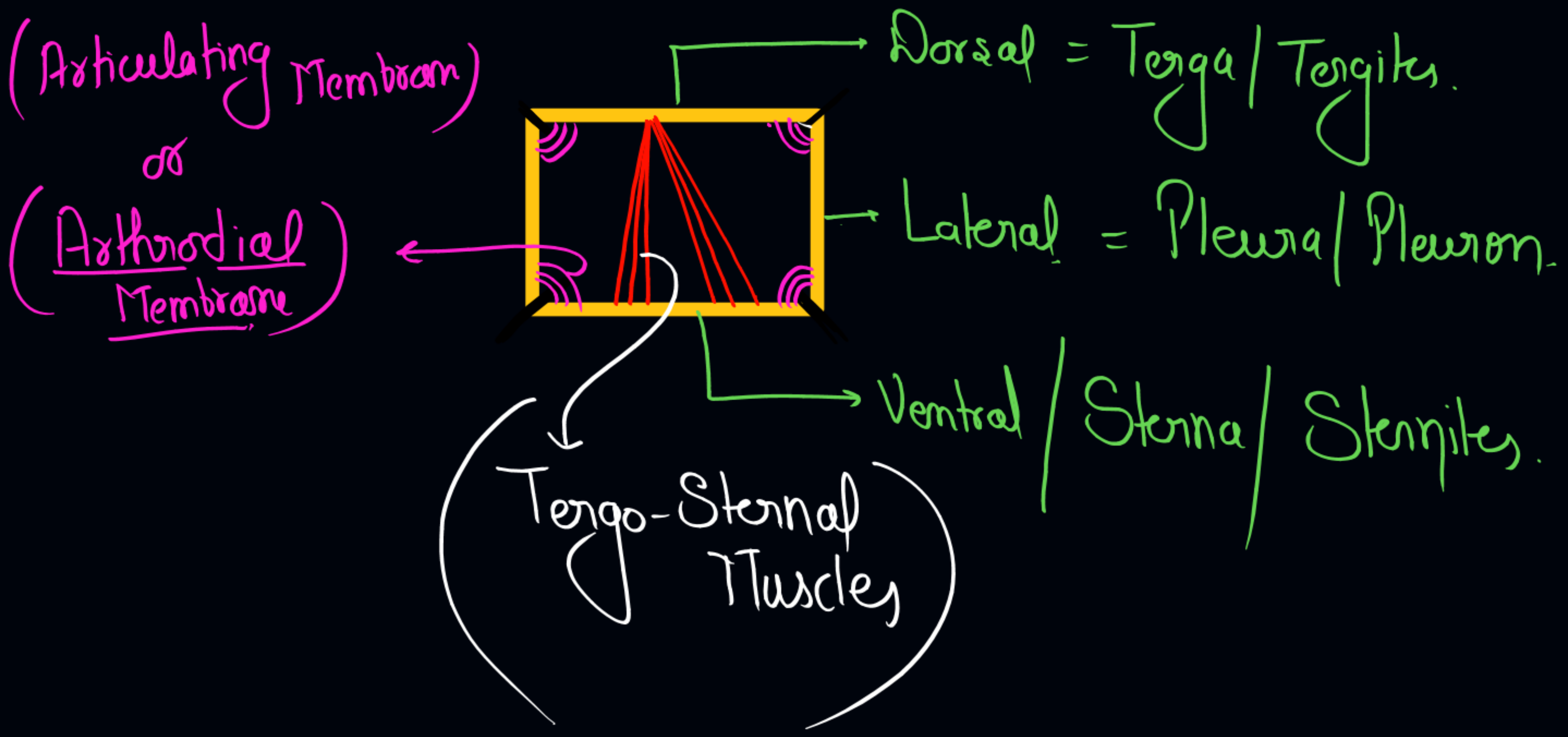


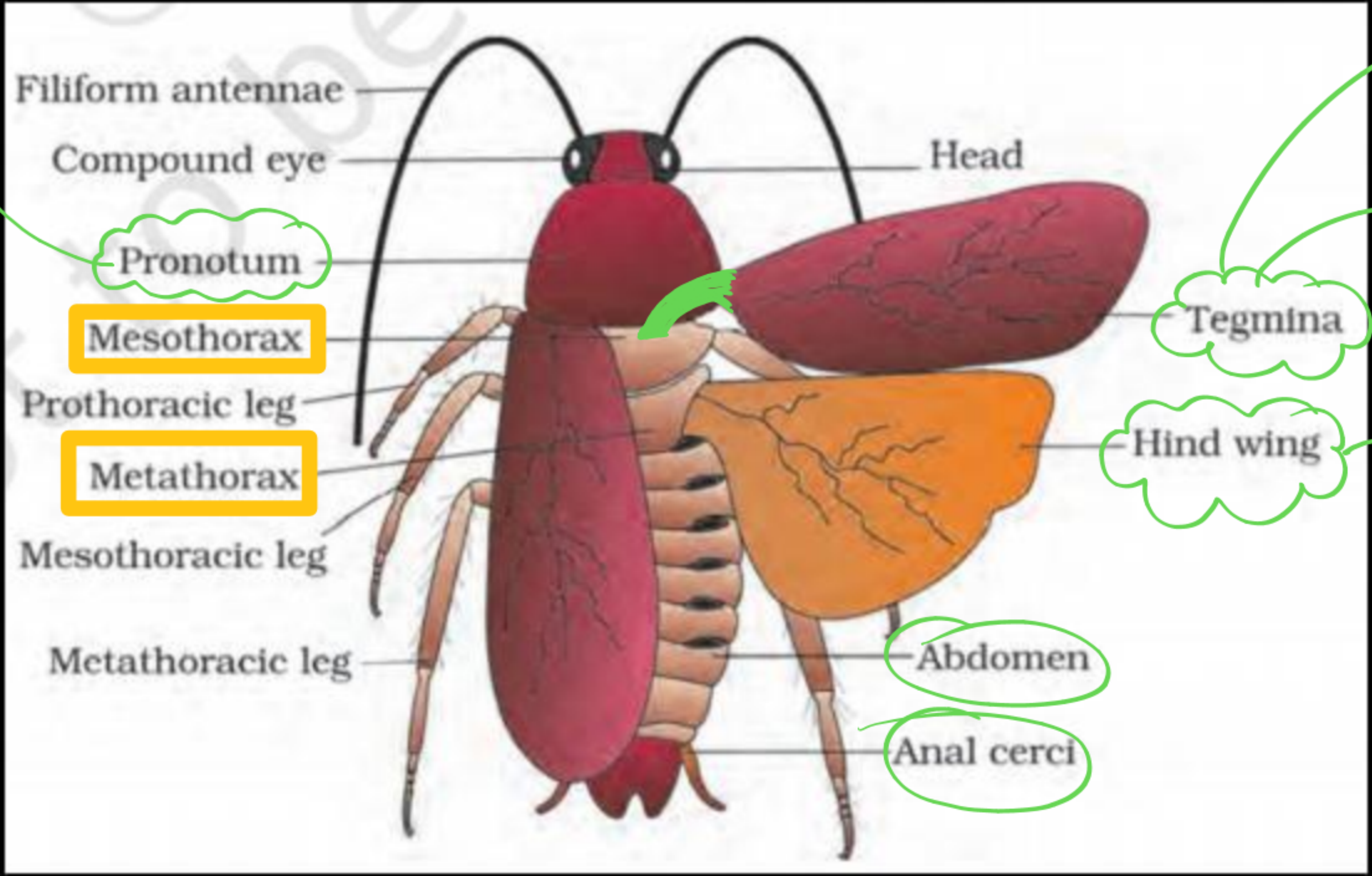
Cockroach -

- Size ranges of cockroach from ¼ inches to 3 inches (0.6-7.6 cm)
- The adults of the common species of cockroach, *Periplaneta americana* are about 34-53 mm long with wings that extend beyond the tip of the abdomen in males.
- They are nocturnal omnivores that live in damp places throughout the world.
- They have become residents of human homes and thus are serious pests and vectors of several diseases.

Exoskeliton of Cockroach →

Exoskeliton form by - Chitinous plates, Called = Sclerites




Filiform antennae
Compound eye
Head
Pronotum
Mesothorax
Prothoracic leg
Metathorax
Mesothoracic leg
Metathoracic leg
Tegmina
Hind wing
Abdomen
Anal cerci
Covering of Prothorax
join with Mesothorax
Forewings.
②
join with Metathorax

Body Segments

	Embryo	Adult
Head →	6	1 (NCERT)
Thorax →	3	3
Abdomen →	11	10
	20	14

(1) Head - vvImp

(A) Covering & Mouth part

Frons → Vertex

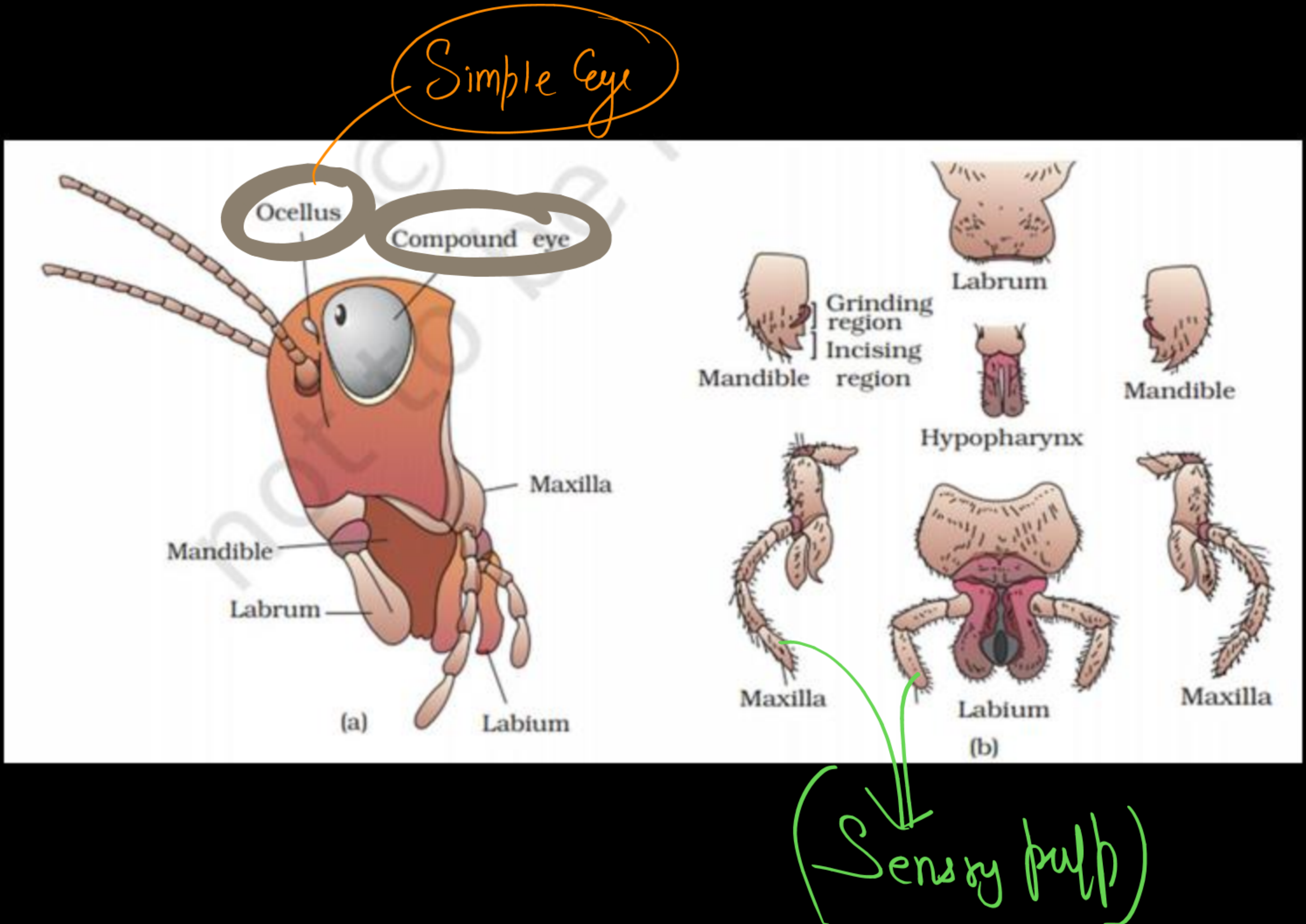
Gena — Frons → Gena

Frons ↓ [Clypeus]

[Mouth part] = Biting & Chewing type

1) - Labrum → Upper lip.
2) - Labium → Lower lip
3) - Hypopharynx → Tongue.
4) - Mandible. → jaw with Chitinous Teeth.
5) - Maxilla. → With Maxillary pulp. (Sensory)

Sec. Maxilla
↓
one pair
Sensory
Pulp ant


Simple eye
Ocellus
Compound eye
Maxilla
Mandible
Labrum
Labium
(a)
Labrum
Grinding region
Incising region
Mandible
Hypopharynx
Mandible
Maxilla
Labium
Maxilla
(b)
Sensory pulp

(B) **Antennae** → one pair, Segmented, Sensory Nature → Monitoring the environment (NCERT)

(C) **Eyes** (Sensory) →

- Simple Eye = Occilus (one pair)
- Compound Eye → one pair → Responsible for Vision.
  - unit = Ommatidia (2000 tnt in Each Eye)
  - Vision = Mosaic.
  - Image = Apposition.





THANK YOU !!

MANTHAN NEET 1.0 & 2.0

STRUCTURALORGANISATION IN ANIMALS – Cockroach-2

LECTURE - 4

ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

- ❑ Cockroach-2



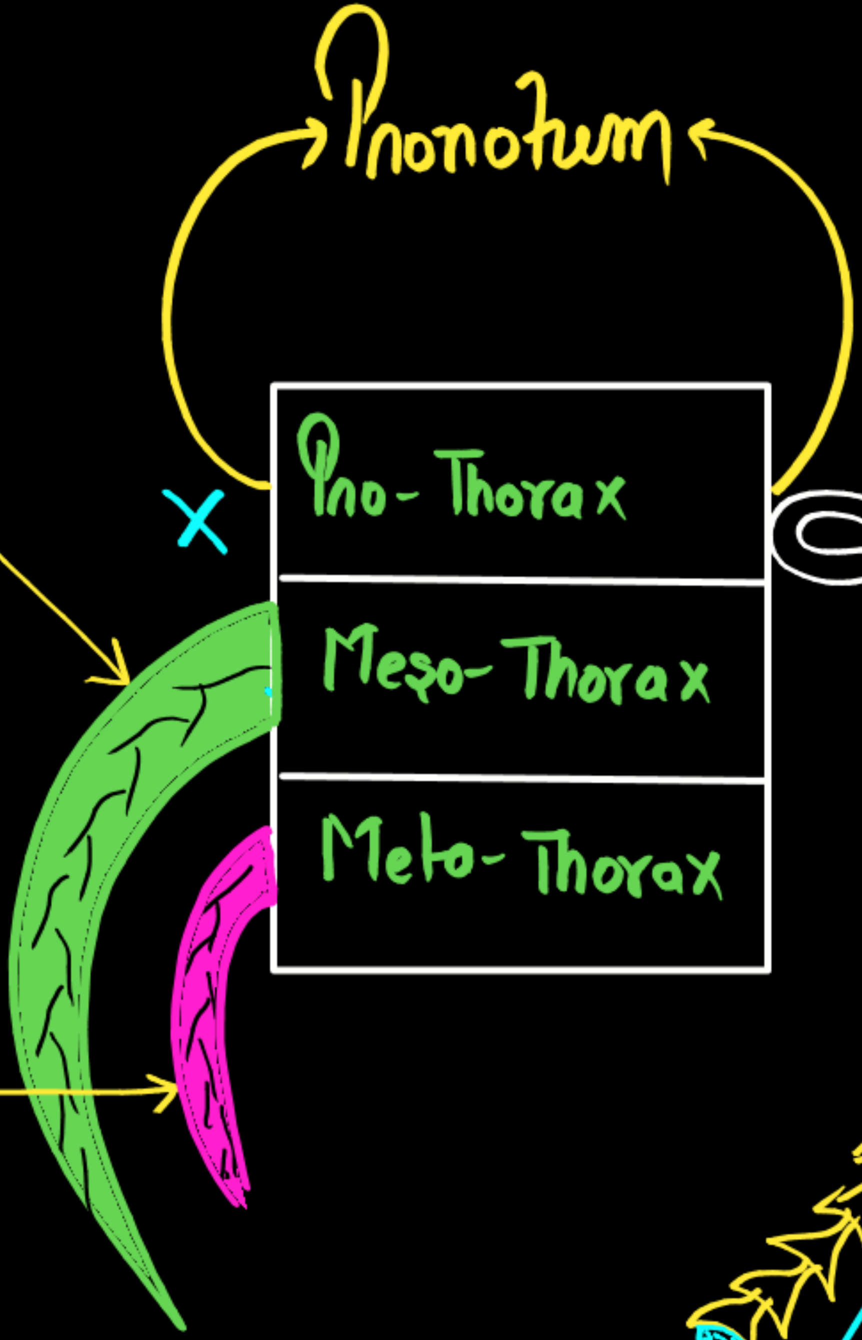
(2) Thorax -

Wings = 2-pairs

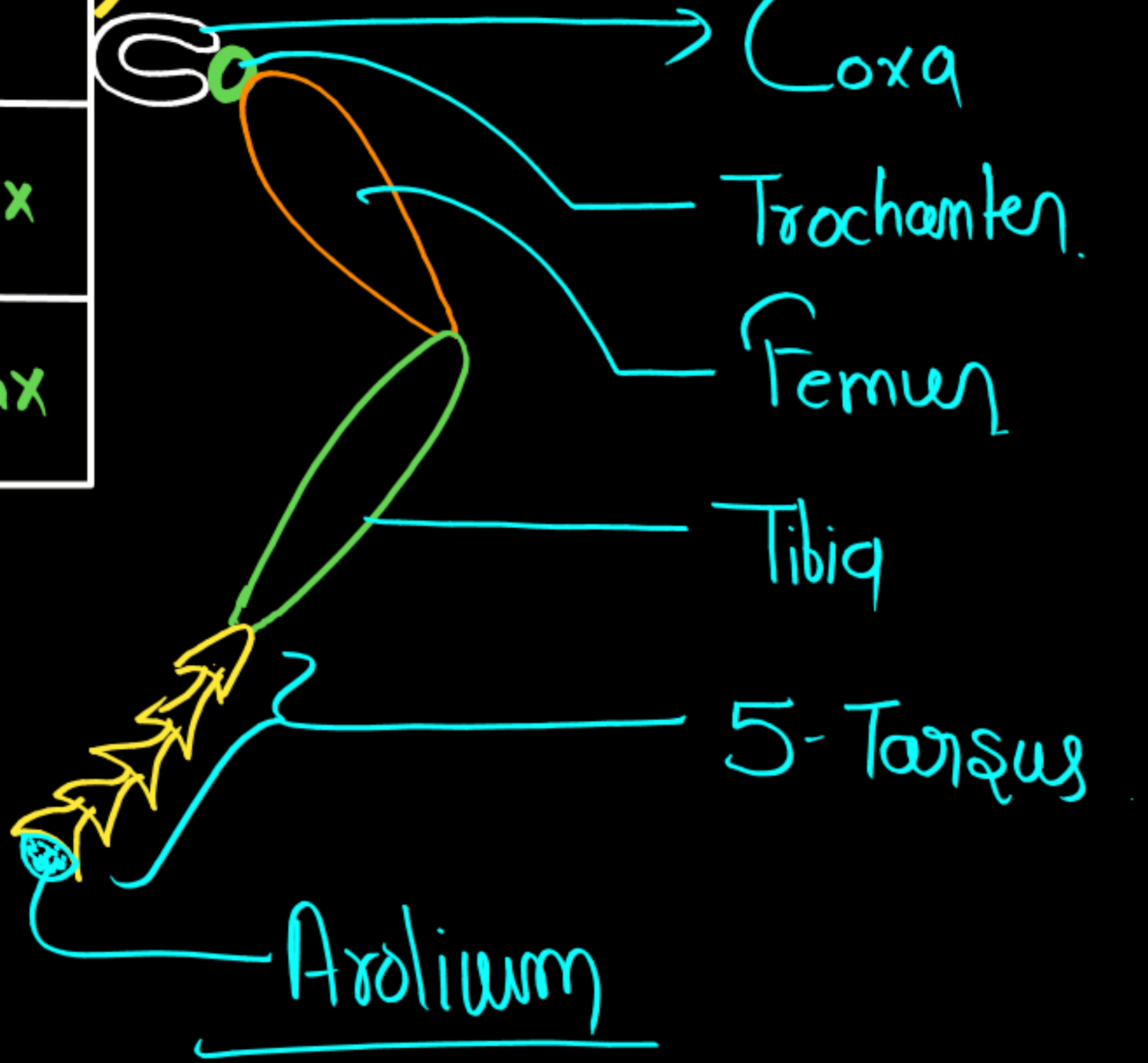
1) - Fore Wings (Tegmina / Elytra)

Thick, Chitinous, Dark.
Strong for = Protection of Hind Wings.

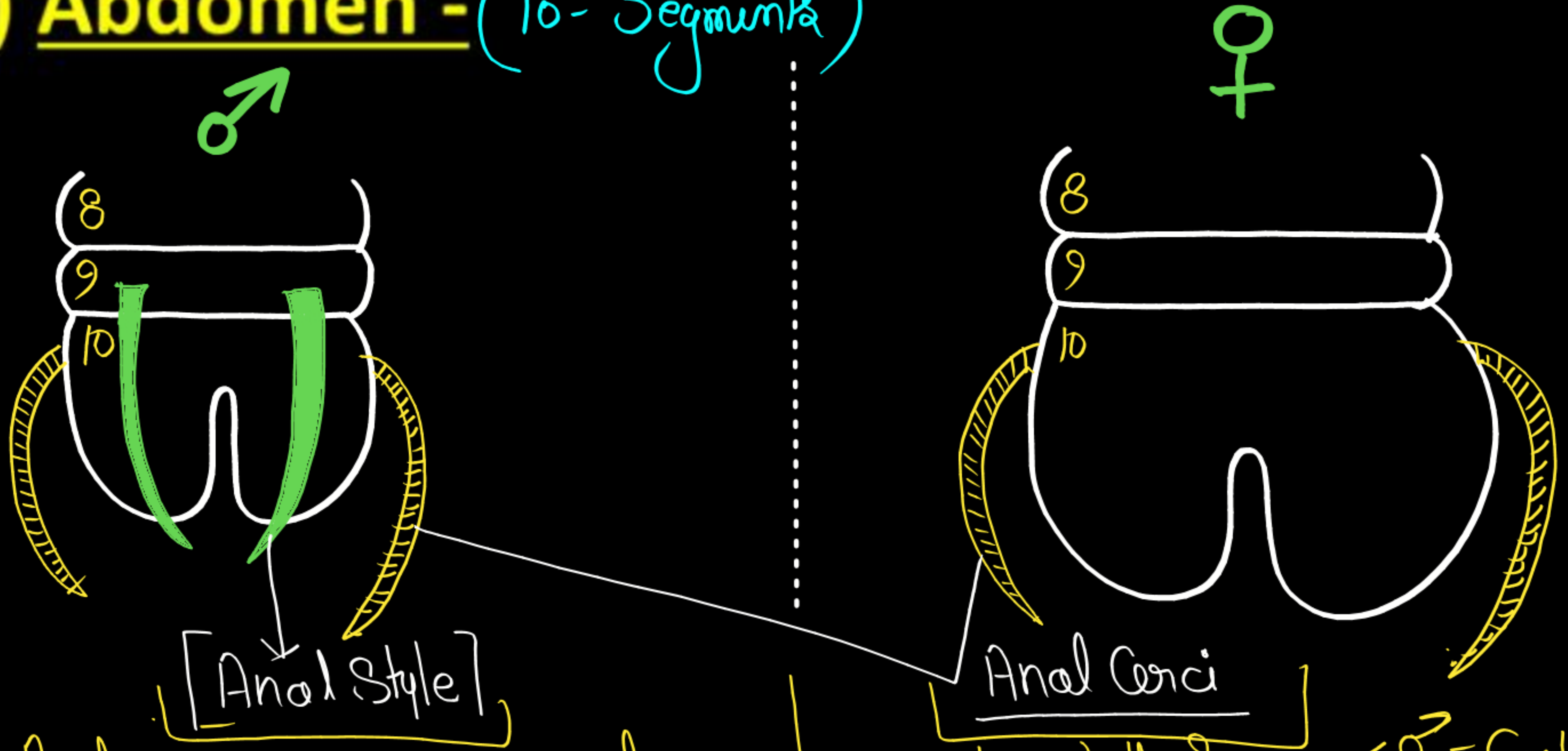
2) - Hind Wings
↓
Thin, Membranous.
Transparent for Flight



Legs = 3- Pairs (One pair tnt in each Seg.)



(3) Abdomen - (10- Segments)



- Anal Style +nt only in Male
- One pair, unsegmented, +nt on 9th Segments.
- Help in Copulation

- +nt in both Sex < ♂ - Cockroach, ♀ - Cockroach.
- One pair, Segmented +nt on → 10th Segments.
- Sensory Receptors are +nt

Genital Pouch / chamber →



(Female)

- 7 + 8 + 9 = Sterna.
  - 7 → Large + Boat Shape
- Anterior or Dorsal
  - → Female gonopore
  - → opening of spermatheca.
  - → opening of Collateral glands.
- Posterior or Ventral. → Gonapophysis.

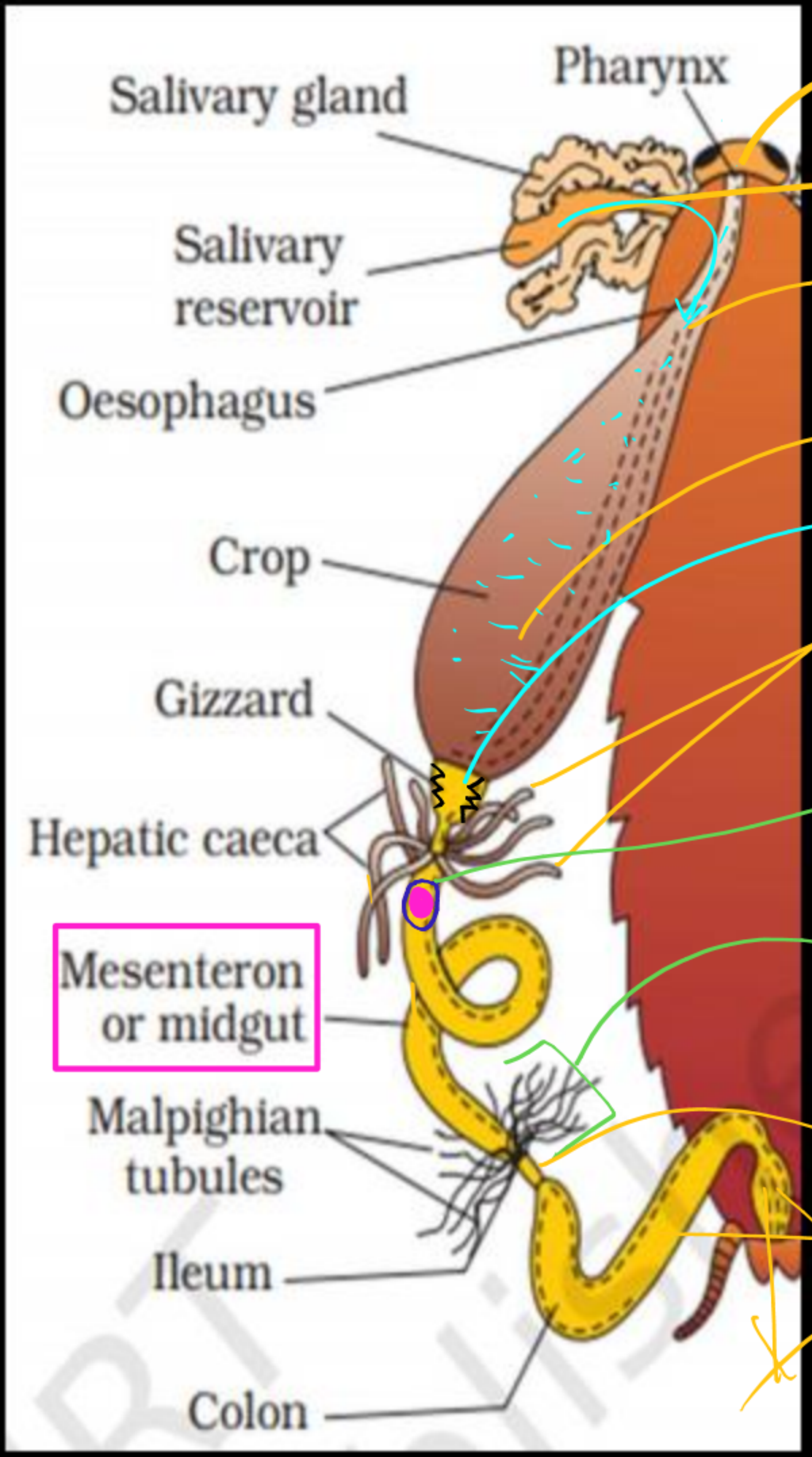
(Male)

- 9 + 10 – Terga (Dorsal)
- 9 – Sterna (Ventral)
- Anterior or Dorsal = Anus
- Posterior or Ventral = External genitalia or Gonapophysis or Phallomeres.

Anatomy of Cockroach

(1) Alimentary canal -

- Fore gut
  - Origin = Ectodermal
  - Cuticle = +nt
  - Mouth → Gizzard / Proventriculus
- Midgut
  - Origin = Endodermal
  - Cuticle = -nt
  - Mesenteron → Max^{m}
    - Digestion
    - Absorption
- Hind gut
  - Origin = Ectodermal
  - Cuticle = +nt
  - Ilium → Rectum



→ Mouth.

Salivary gland: → One pair, Secrete - Starch Digestive Enzym.

Oesophagus

Crop → Storage & Digestion of food.

Gizzard / Proventriculus ⇒ 6 - chitinous Teeth for grinding of food.

Hepatic Caeca or Gastric Caeca } → (6-8) = Secrete - Fat, Protein, Carbohydrate. Digestive Enzymes

→ Pnt at the junction of Fore gut & Mid gut

Peritrophic Membrane

- → Secrete by - Wall of Midgut
- → Permeable for → Digestive Enzymes
  - → Digestive - food.

Malpighian Tubules → (100-150) → For Excretion → Pnt at the junction of Midgut & Hind gut.

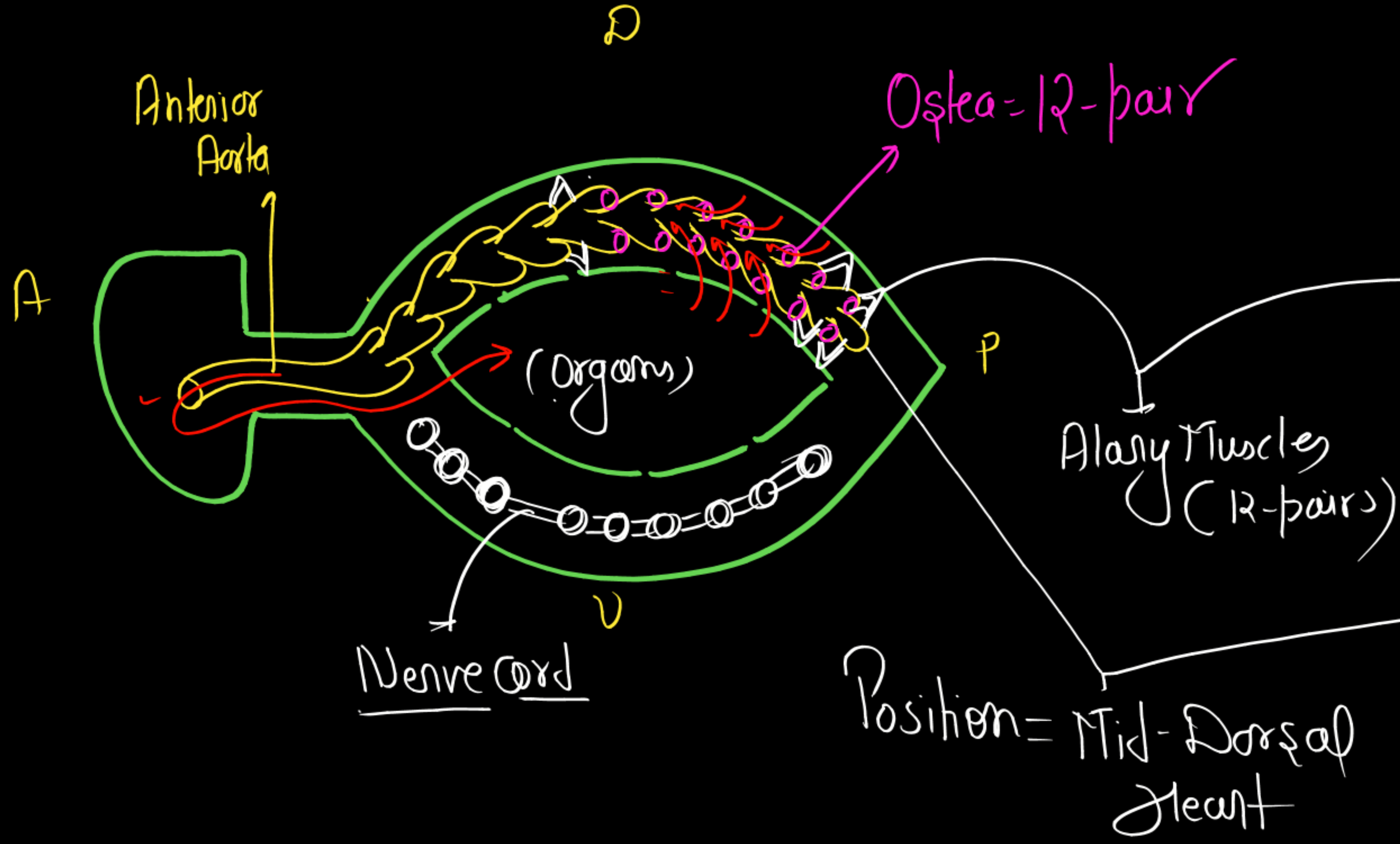
Ilium

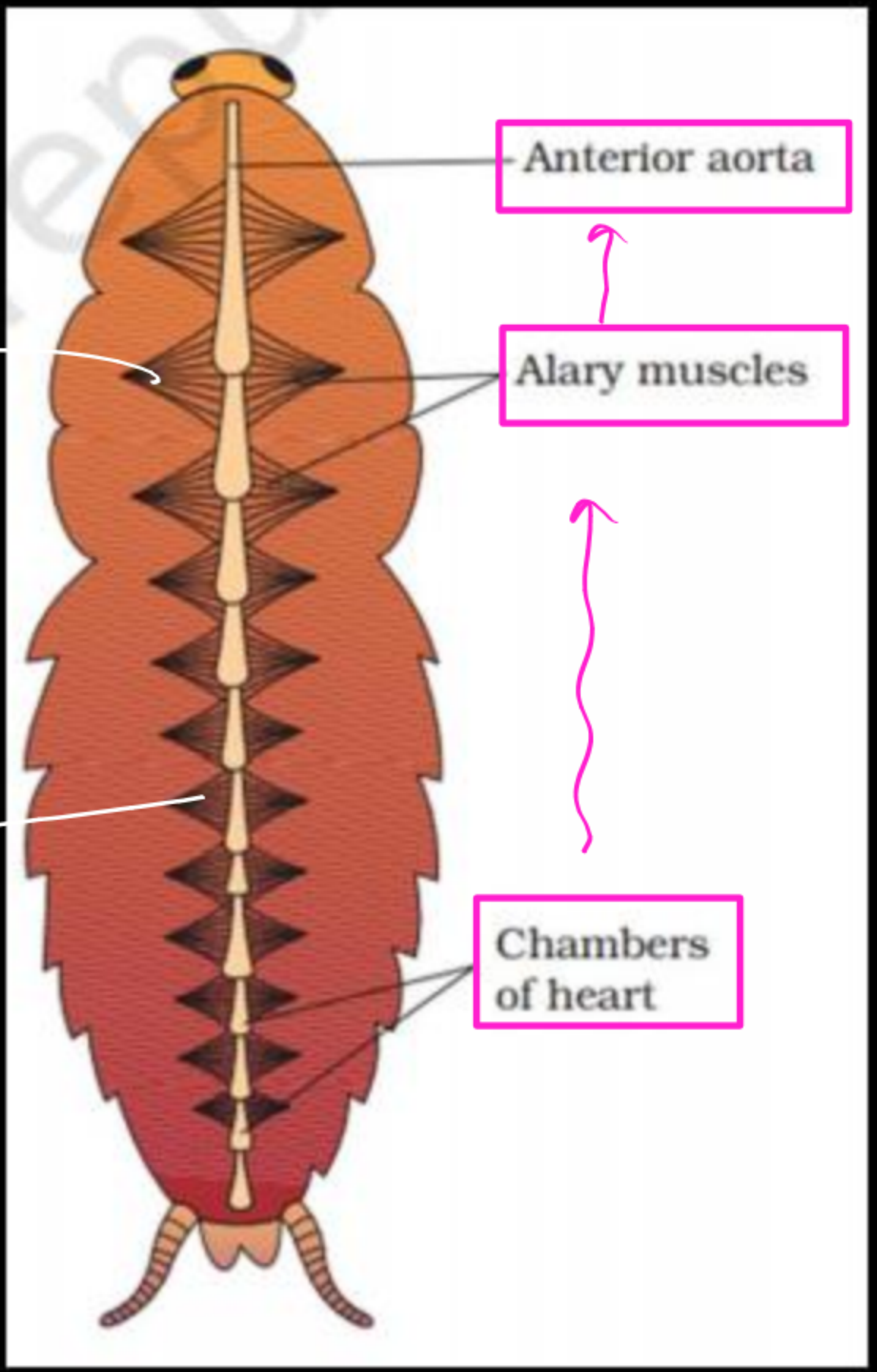
Colom

Rectum (6 - Rectal Papillae) = For absorption of Water

(2) Circulatory System - [Open - Type]

- Heart = Tubular, Neurogenic - 13 - chambered.
- Blood = Haemolymph.
  - Plasma
  - Haematocytes.
- Blood Sinus = Haemocoel
  - Pnt in open Circulatory System.

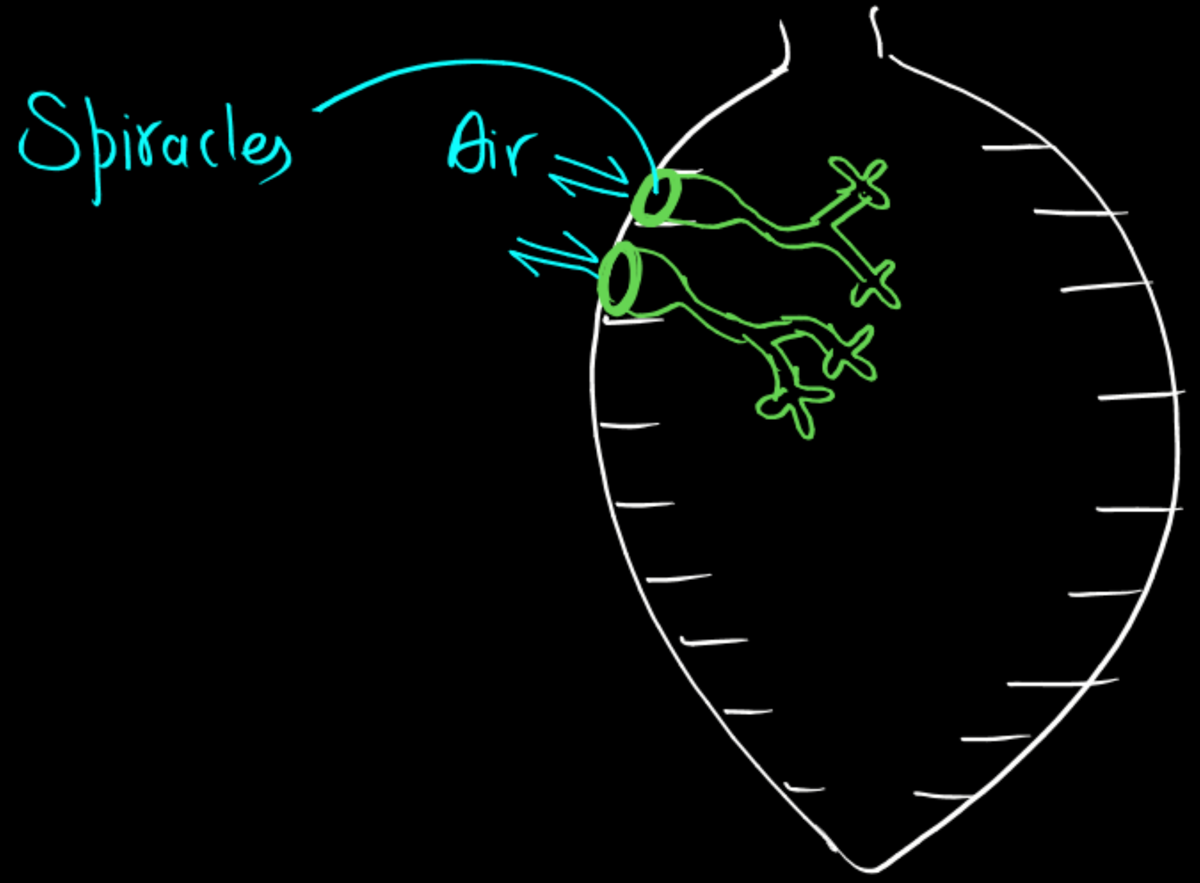

D
Anterior Aorta
Ostea = 12-pair
A
(Organs)
P
Alary Muscles (12-pairs)
Nerve cord
V
Position = Mid-Dorsal Heart

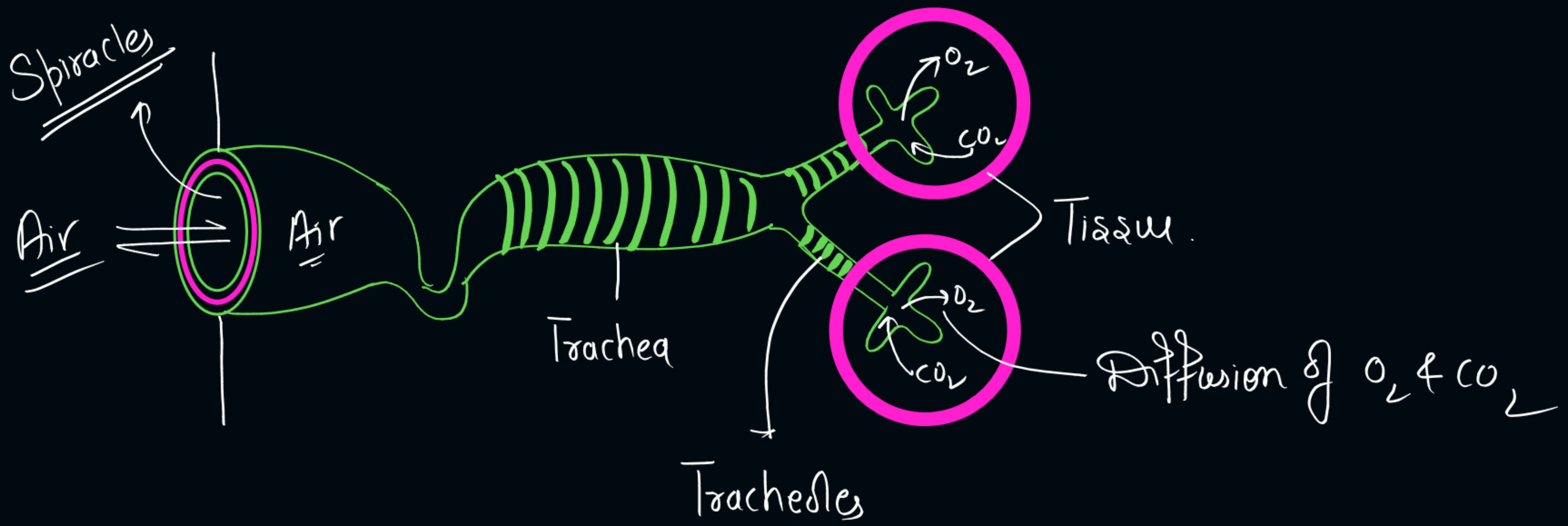

Anterior aorta
Alary muscles
Chambers of heart

(3) Respiratory system -

* Network of Tubules (Trachea) open out Side through Small Opening, Called = Spiracles.

Total No. of Spiracles = 10 - pairs
- 2 - pairs = Thorax
- 8 - pairs = Abdomen





Spiracles
Air
Air
Trachea
Tracheoles
O_2
CO_2
O_2
CO_2
Tissue.
Diffusion of O_2 & CO_2

H.W

1. The body of cockroach can be morphologically distincted as.
A) head and abdomen
B) head, thorax and abdomen
C) head, abdomen and tail
D) head and trunk

2. Consider the following statements:
a) Body of cockroach is covered by hard exoskeleton made up of chitin.
b) In male cockroach, the wings extend beyond the abdomen.
Select the correct option
A) a is true, b is false
B) Both a and b are false
C) a is false, b is true
D) Both a and b are true

3. Which of the following features is used to identify a male cockroach from a female cockroach?
A) Presence of a boat shaped sternum on the 9th abdominal segment
B) Presence of caudal styles
C) Forewings with darker tegmina
D) Presence of anal cerci

4. Hardened plates of exoskeleton in cockroaches are known as
A) capsids
B) spicules
C) sclerites
D) metamere

5. Dorsal and ventral sclerites in cockroach are
A) tergites and sternites, respectively
B) sternites and pleurites, respectively
C) pleurites and tergites, respectively
D) pleurites and sternites, respectively

6. The mouth parts of cockroach contain
A) two mandibles, two maxillae, labrum, labium and hypopharynx
B) two mandibles and maxillae each, two labrum and labium each
C) one mandible and maxilla each, labarum and hypopharynx
D) one mandible, labarum, labium and hypopharynx

7. Select the incorrect statement regarding cockroach:
A) Hypopharynx acts as a tongue.
B) Head is mobile in all directions due to flexible neck.
C) Antennae possess sensory receptors to monitor the environment.
D) Thorax is greatly reduced and non-divisible.

8. . Paired walking legs in cockroaches are found on
A) each thoracic segments
B) mesothorax and metathorax
C) prothorax and metathorax
D) metathorax only

9. Forewings and hindwings in cockroaches arises from
A) mesothorax and metathorax
B) prothorax
C) metathorax
D) prothorax and metathorax

THANK YOU !!

MANTHAN NEET

STRUCTURALORGANISATION IN ANIMALS –Cockroach & Frog

LECTURE - 5

ZOOLOGY



MD SIR

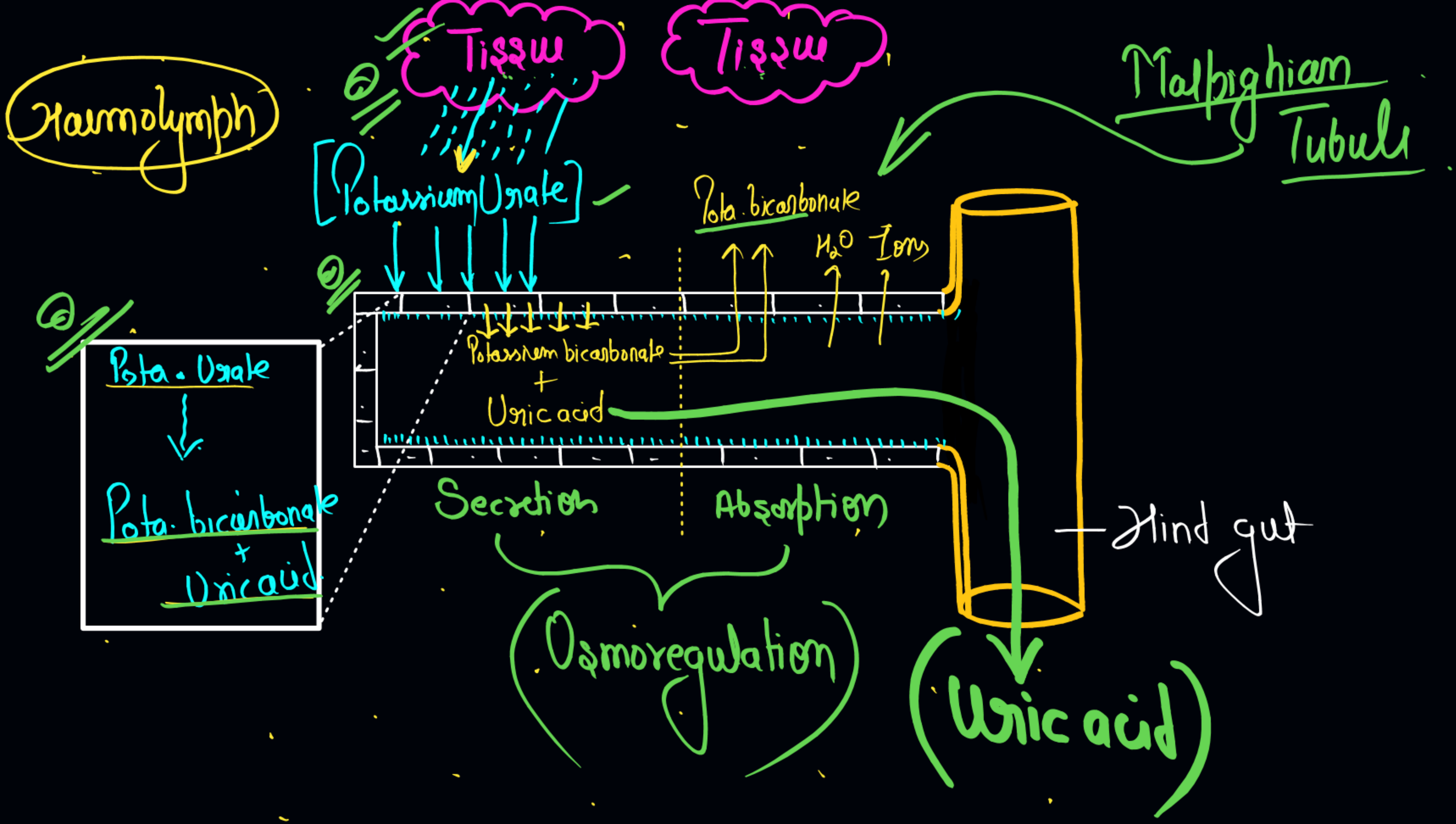
❑ TODAY'S GOAL -

- ❑ Cockroach ✓
- ❑ Frog ✓

(4) Excretory System -

* Main Excretory Organ = Malpighian Tubules [100-150] = Ciliated & Secretory Epithelium.
* Other Ex. Organs = Nephrocytes, Uricose glands (Only tnt in ♂ Cockroach), Fat bodies
* Excretory Sub. = Uric acid

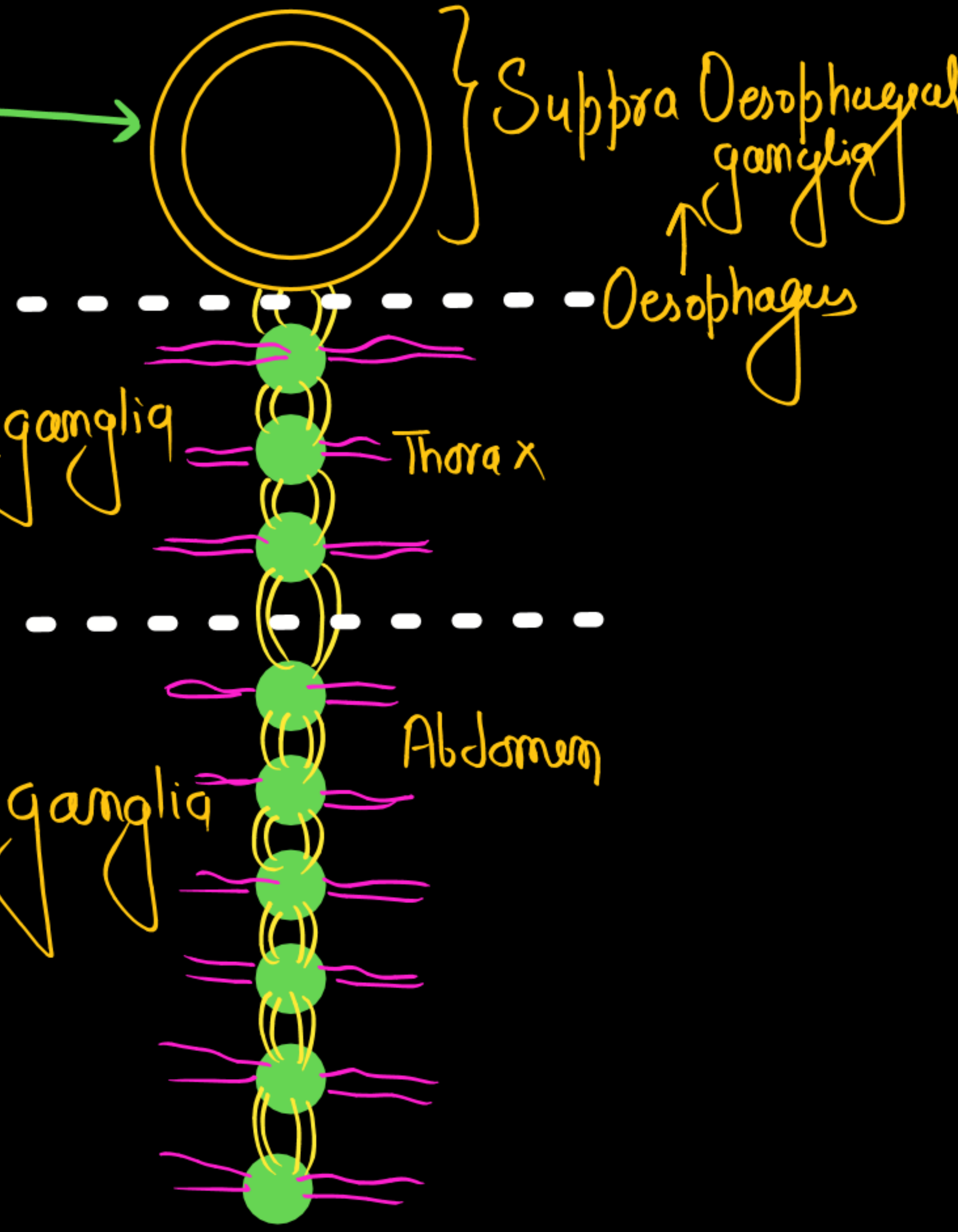
(Uricotelic Animals)


Haemolymph
Tissue
Tissue
Malpighian Tubule
[Potassium Urate]
Pota. bicarbonate
H_2O
Ions
Pota. Urate
Pota. bicarbonate
+
Uric acid
Potassium bicarbonate
+
Uric acid
Secretion
Absorption
Hind gut
Osmoregulation
(Uric acid)

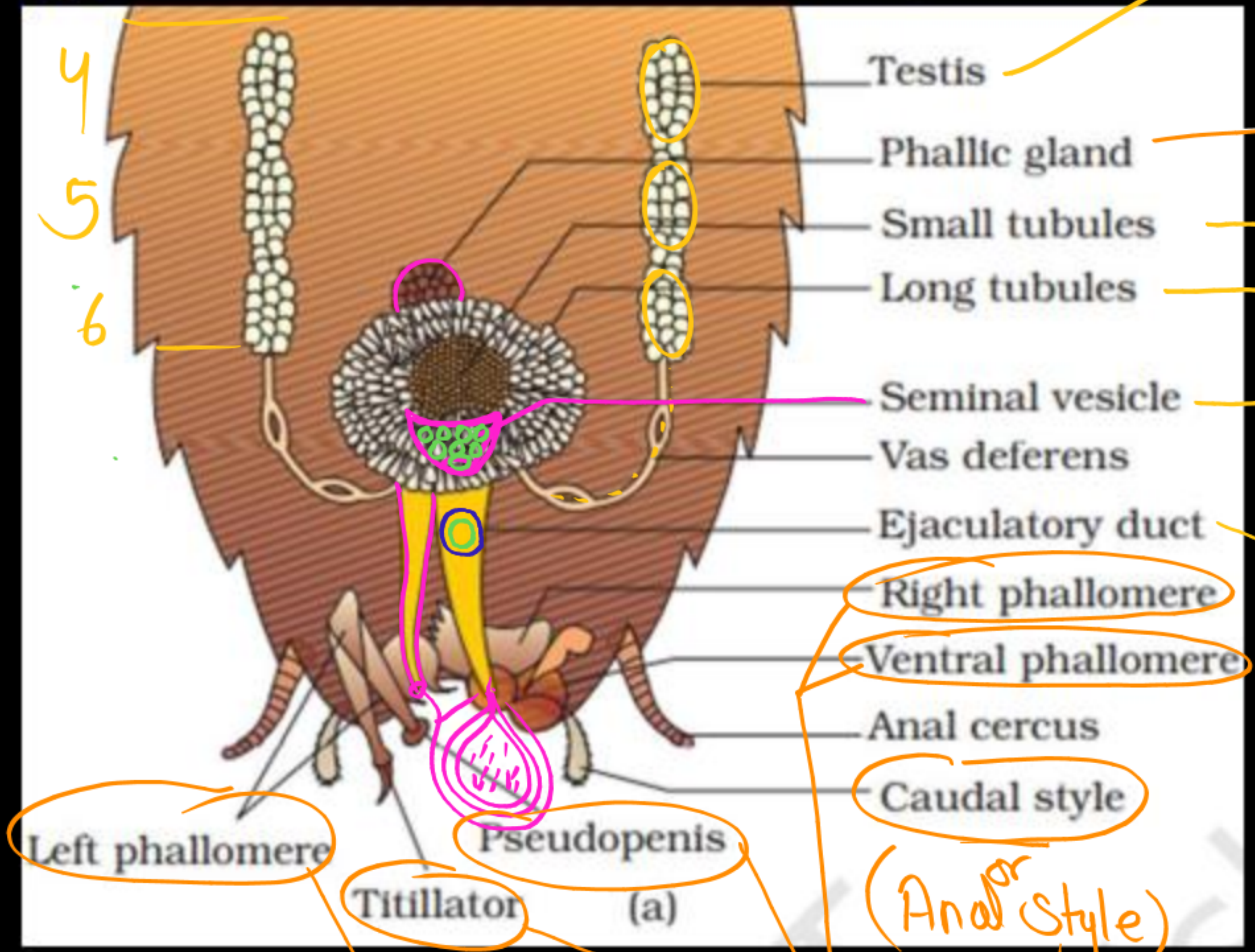
(5) Nervous System

- → Brain = Suppra Oesophageal ganglia
- → Nerve Cord = 9-ganglia
  - → 3-ganglia
  - → 6-ganglia

Nerve Cord ↓ Double + Solid + Ventral



(6) Male Reproductive System



Testis → One pair (Tri-lobed) = [4-6 Segments)
→ Formation of Sperms

Phallic gland → Secrete = Outer layer of Spermatophore

Small tubules → Fill Nutrition in Spermatophore
Long tubules → Secrete Inner layer of Spermatophore
Seminal vesicle → Storage of Spermatophore

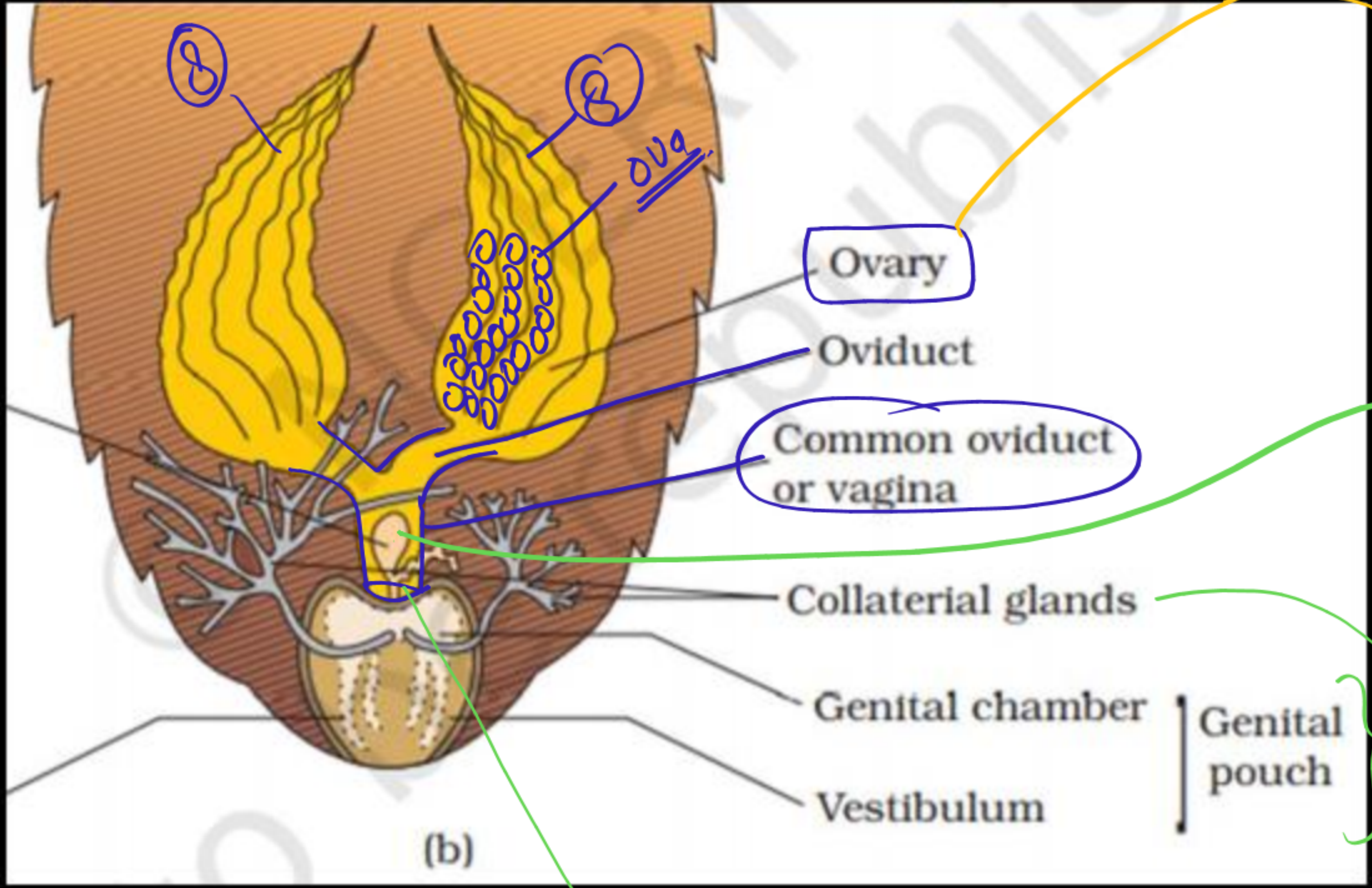
} Mushroom gland ↓ (6 & 7 Seg)

Ejaculatory duct → Secrete - Middle layer of Spermatophore

Caudal style (Anal or Style)

Right phallomere, Ventral phallomere, Left phallomere, Pseudopenis, Titillator → External genitalia

(7) Female Reproductive System-

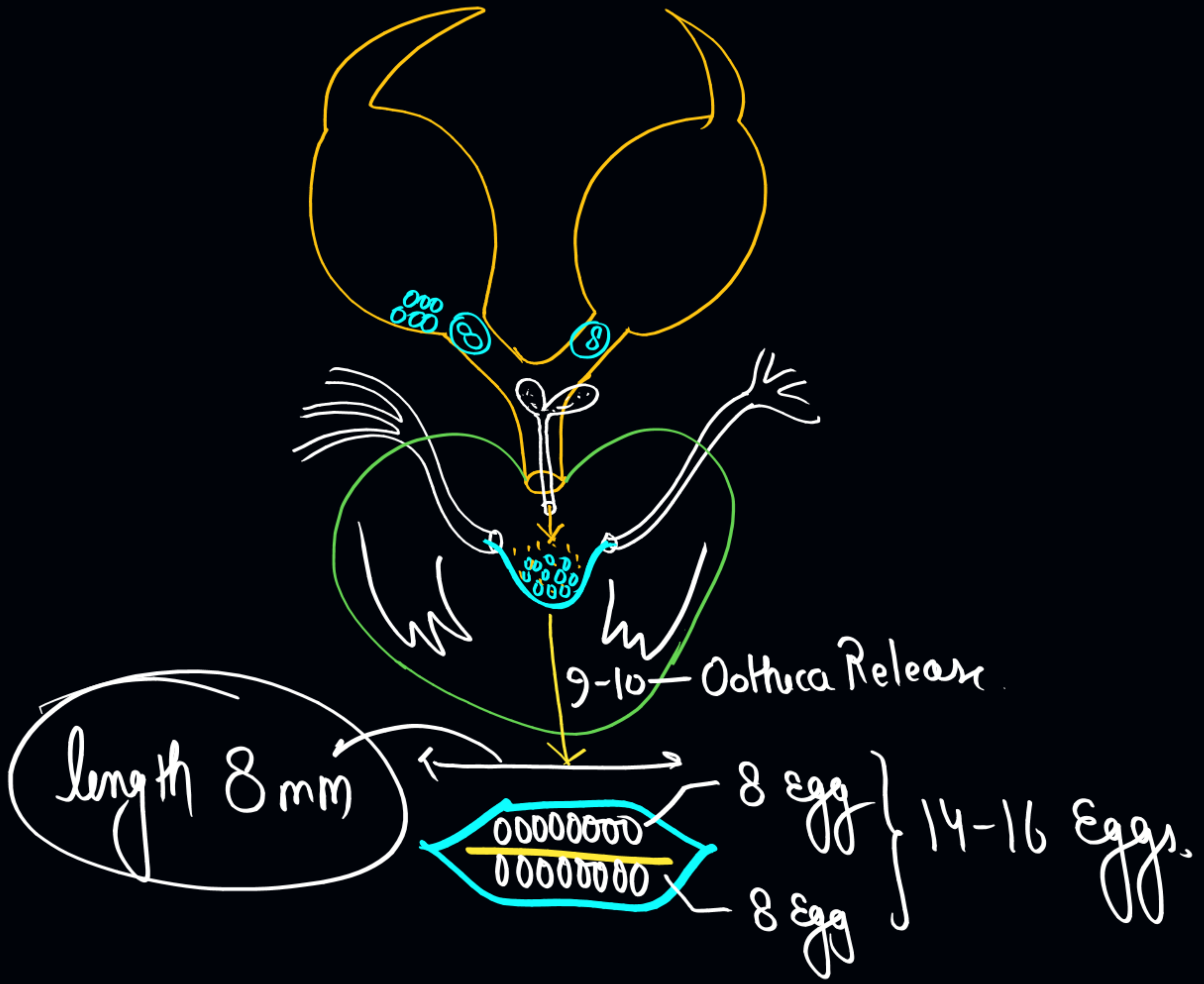


Ovary = One pair [2-6 Segments]
Each ovary contain 8-ovariole
both " " = 8+8 = 16 ovariole.

Spermatheca (one pair) = 6th Seg.
↳ Collect sperms from = Spermatophore

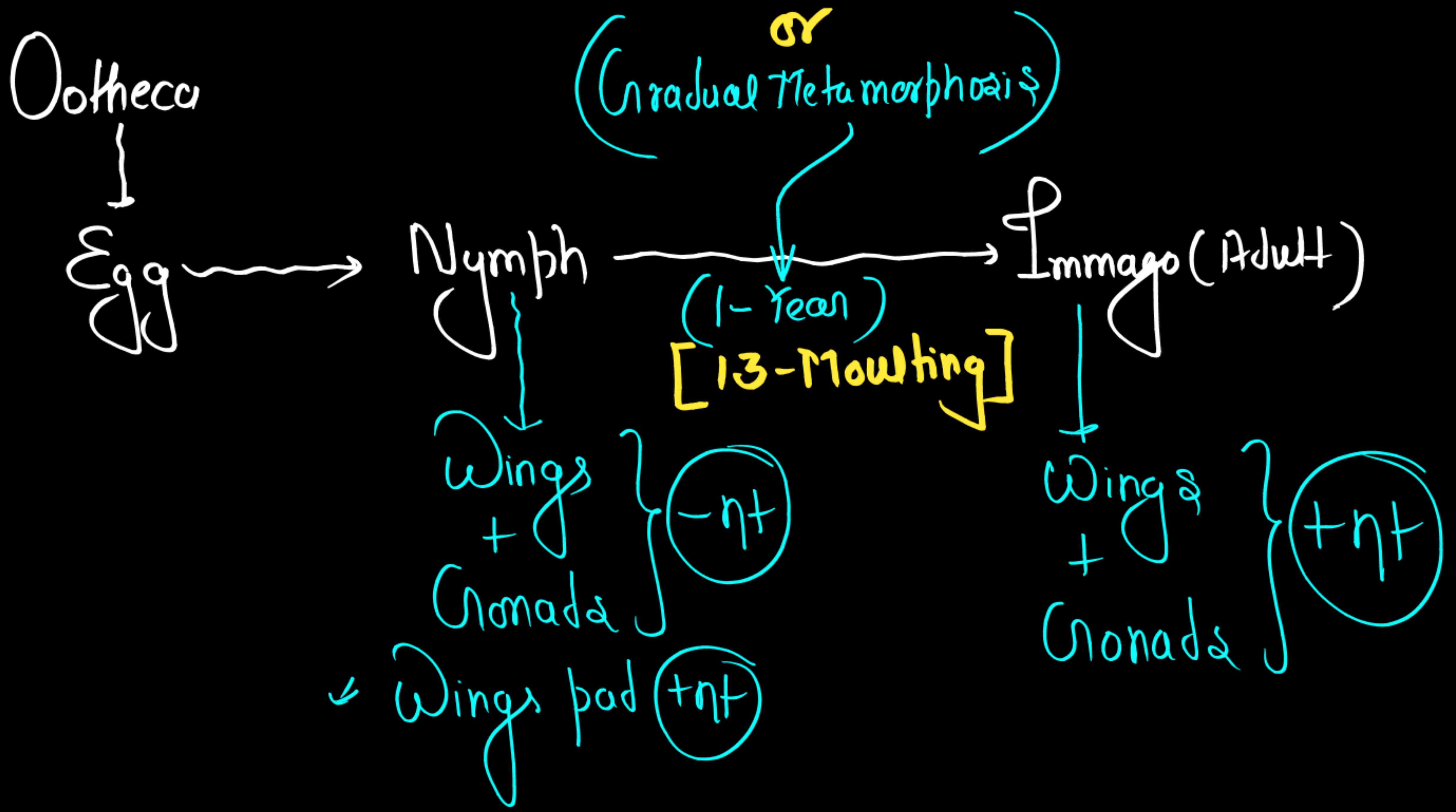
Secrete = Ootheca

7+8+9



9-10 — Oothuca Release
length 8 mm
8 Egg
8 Egg
14-16 Eggs.

Metamorphosis- Paurometabolous Metamorphosis



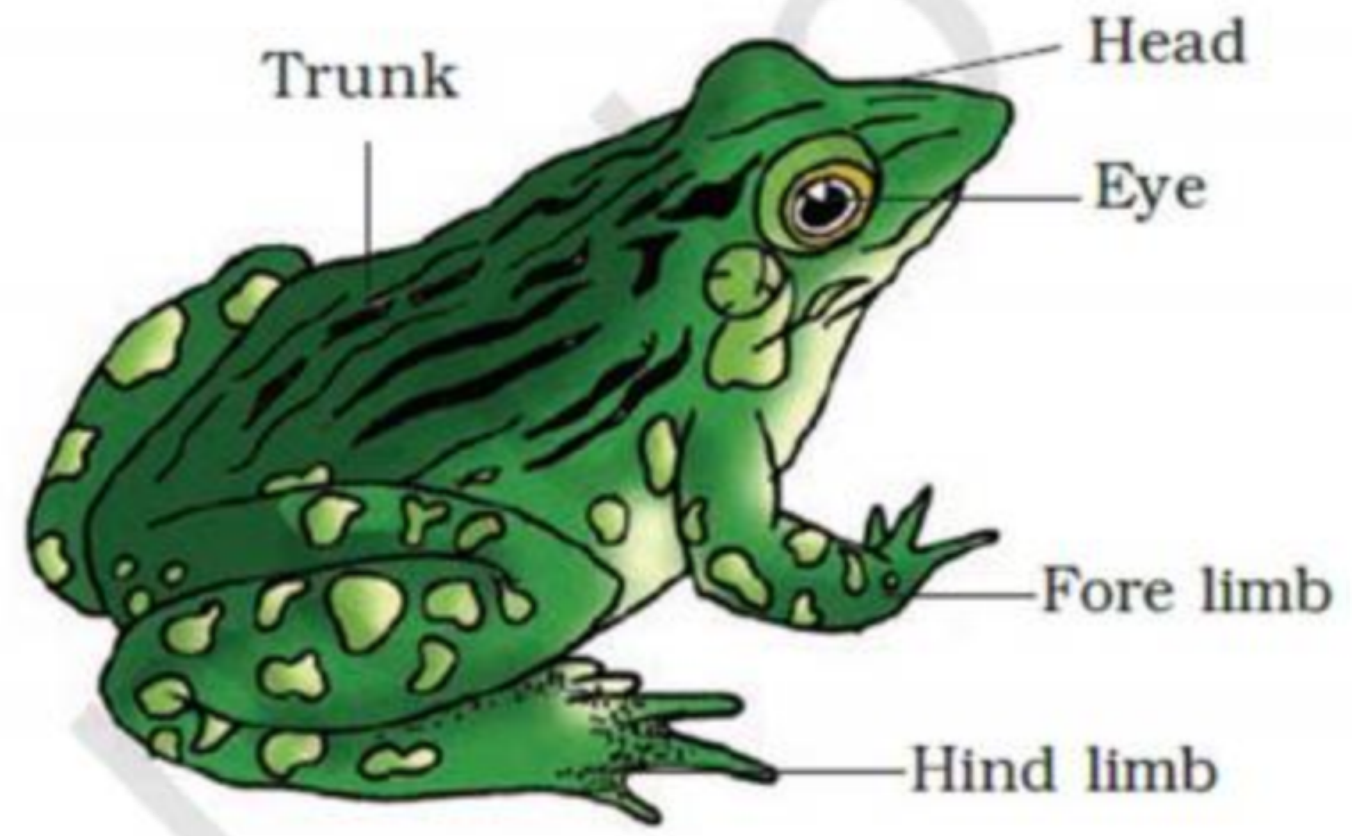


Figure 7.1 External features of frog

Frog

Frog

- Rana tigrina = The most common species of frog found in India.
- They do not have constant body temperature - cold blooded or poikilotherms.
- Summer sleep = Aestivation.
- Winter sleep = Hibernation.
- They have the ability to change the colour to hide them from their enemies = camouflage. This protective coloration is called = mimicry.

H.W.

Thorax + Abdomen → Trunk

Body = Head + Trunk

[Dorsal] Outer Skin → Smooth with Mucus (Olive green)

Ventral Skin – [Paile Yellow]

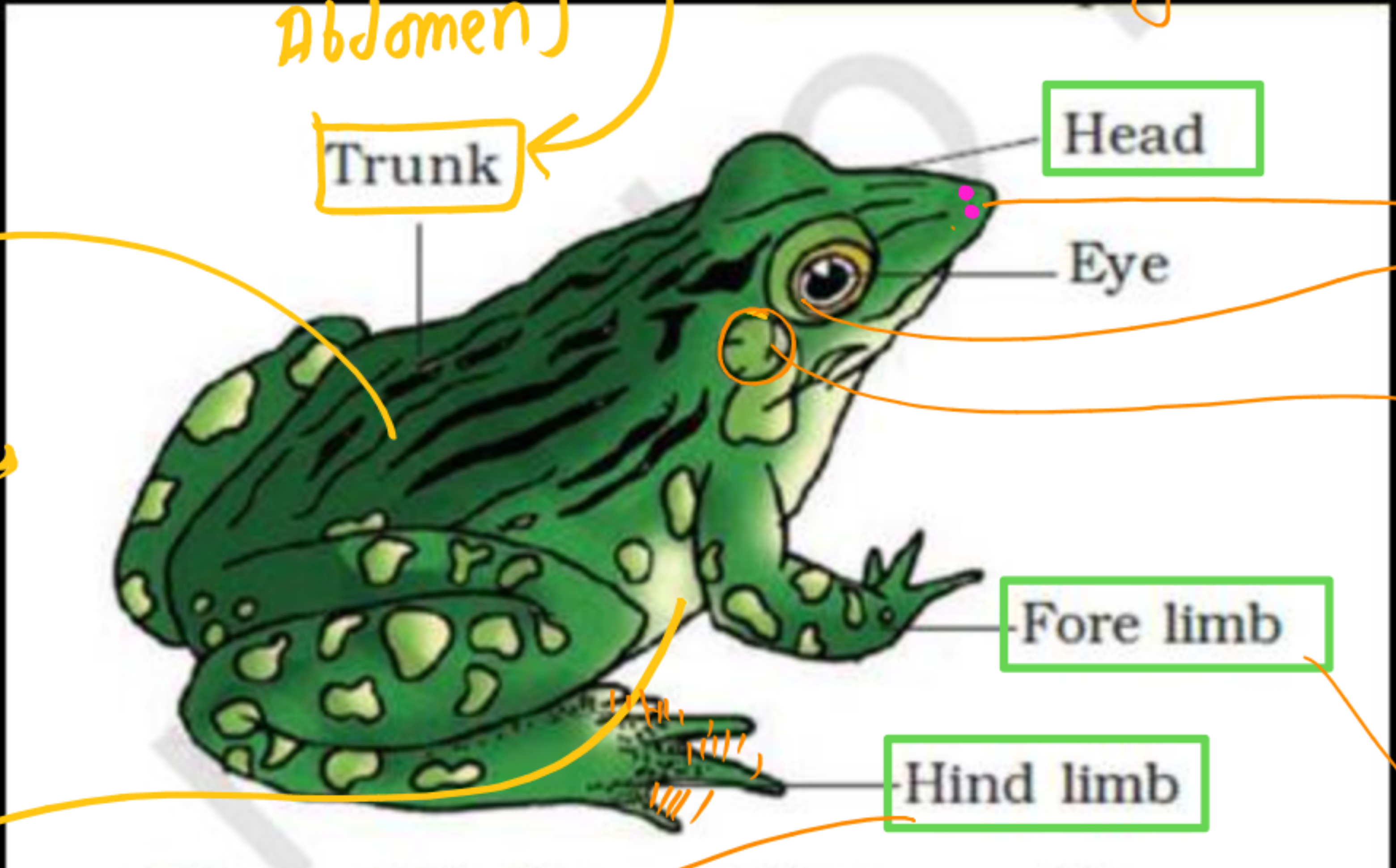


Figure 7.1 External features of frog

one pair Nostrils

Nictitating Membrane [3rd Eys]

Ear (Tympanum / Ear Drum)
- Balancing
- Hearing

4-Digits (Ist, IInd)

{Copulatory pad prnt on Ist Digit of Male Frog}

[Wabbed Digits = 5-Digits]

Morphology of Frog

- The skin is smooth and slippery due to the presence of mucus. The skin is always maintained in a moist condition. = Cutaneous Respiration
- Frog never drinks water but absorb it through the skin.
- Body of a frog is divisible into head and trunk =
- A neck and tail are absent

  Above the mouth a pair of nostrils is present.
- Nictitating membrane = 3rd Eye
- Membranous tympanum (ear) = Ear drum = Middle Ear (Hearing) + Internal Ear (Balancing)
- hind limbs end in = five digits
- fore limbs that end in = four digits
- Feet have webbed digits that help in swimming.
- Frogs exhibit sexual dimorphism, Male frogs - vocal sacs and copulatory pad on the first digit of the fore limbs.

THANK YOU !!

MANTHAN NEET

STRUCTURALORGANISATION IN ANIMALS – Frog

LECTURE - 6

ZOOLOGY



MD SIR

❑ TODAY'S GOAL -

- ❑ Frog

7.2.2 Anatomy

The body cavity of frogs accommodate different organ systems such as digestive, circulatory, respiratory, nervous, excretory and reproductive systems with well developed structures and functions (Figure 7.2).

Digestive System

- Digestive glands
  - Salivary glands
  - Pancreas → Pancreatic juice.
  - Liver → Bile for Emulsification of Fat
- Alimentary Canal [Short → Carnivores]
  - Mouth → Bilobed Tongue +nt
  - Buccal Cavity → Salivary glands.
  - Pharynx
  - Oesophagus
  - Stomach → Acidic food in Stomach. (HCl) = Chyme.
  - Intestine

Intestine → [Short] -

- Duodenum (Max^m digestion)
- Ileum (Max^m absorption → MicroVilli + Villi + nt for absorption)
- Colon
- Rectum → Cloaca [Common opening for — Faeces + Urine + Genitalia]

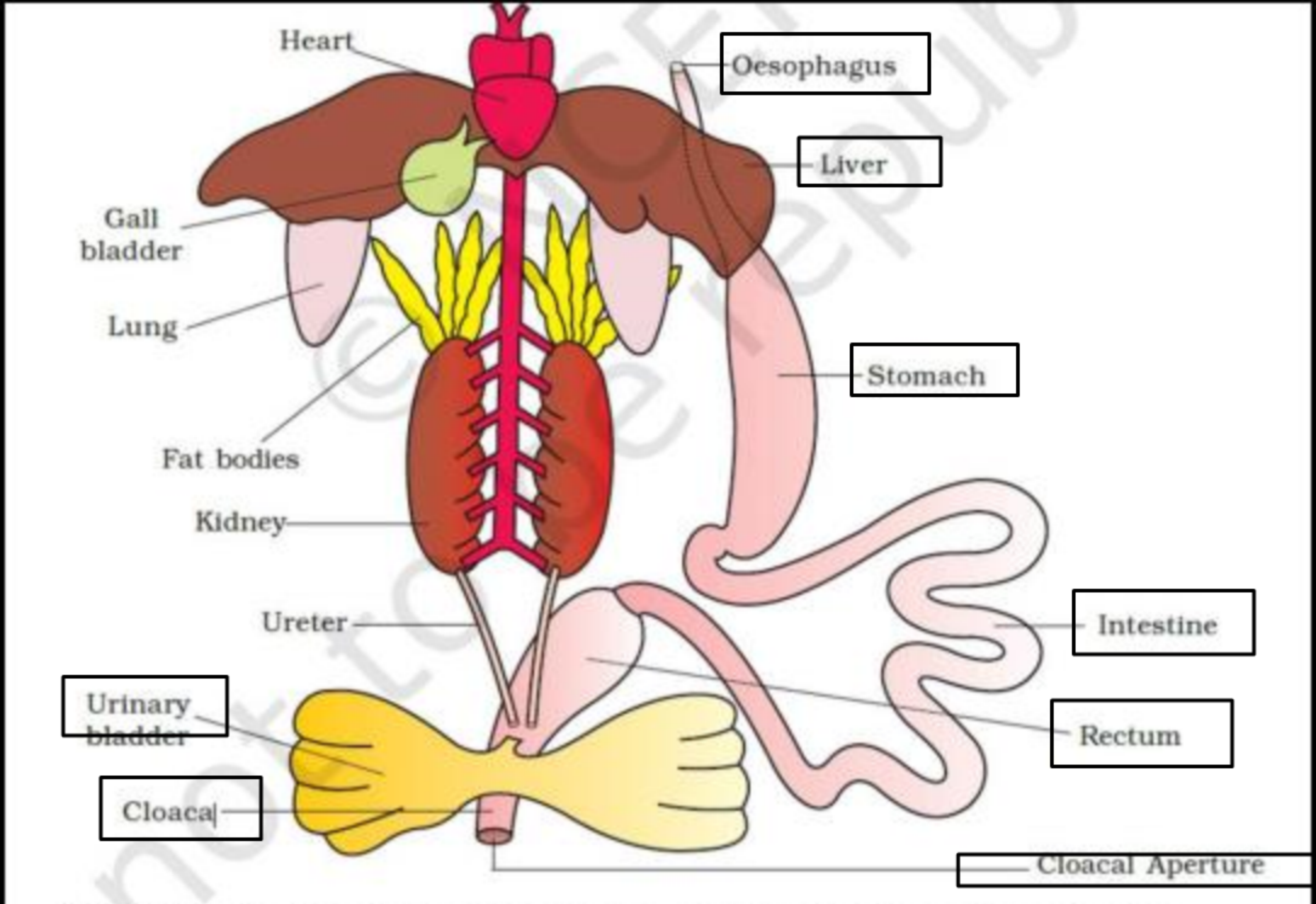
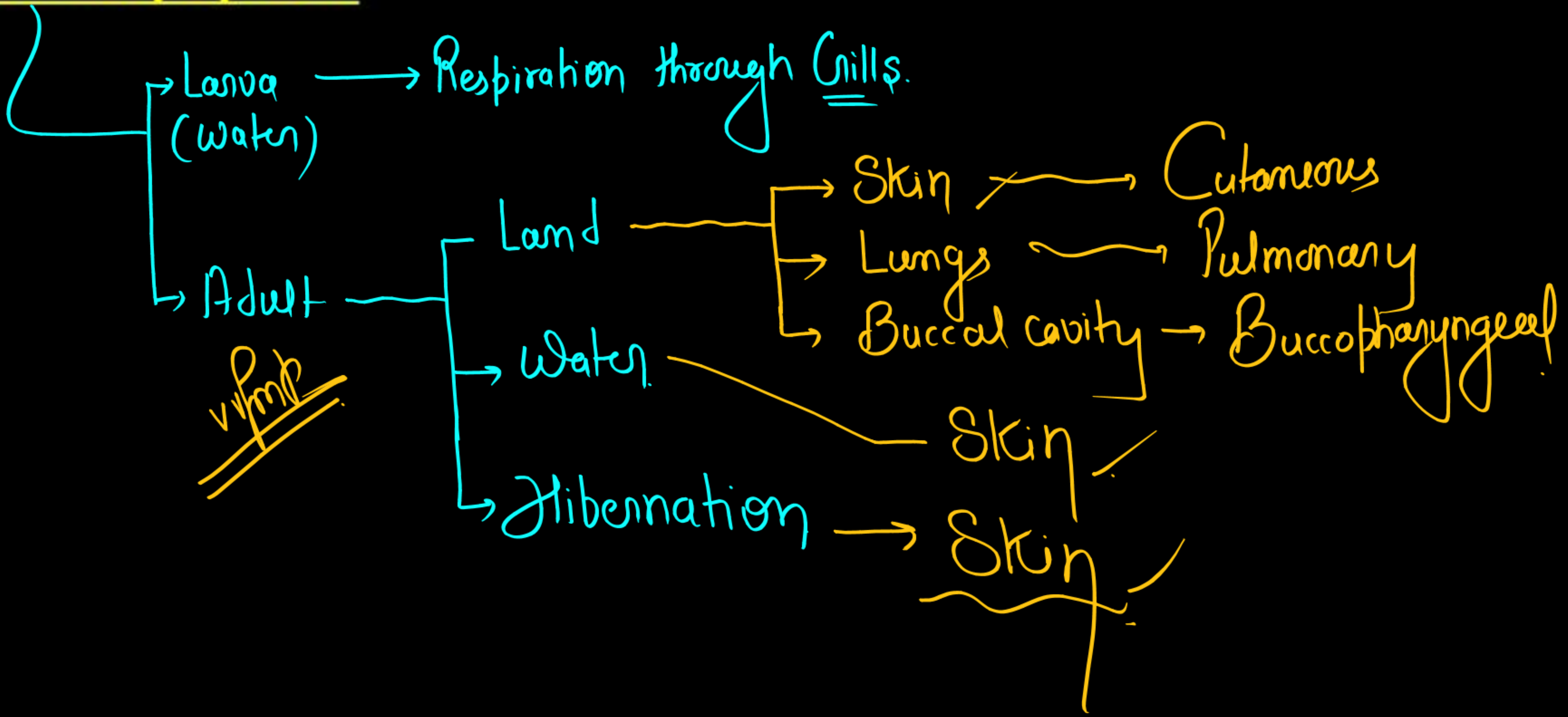


Figure 7.2 Diagrammatic representation of internal organs of frog showing complete digestive system

The digestive system consists of alimentary canal and digestive glands. The alimentary canal is short because frogs are carnivores and hence the length of intestine is reduced. The mouth opens into the buccal cavity that leads to the oesophagus through pharynx. Oesophagus is a short tube that opens into the stomach which in turn continues as the intestine, rectum and finally opens outside by the cloaca. Liver secretes bile that is stored in the gall bladder. Pancreas, a digestive gland produces pancreatic juice containing digestive enzymes. Food is captured by the bilobed tongue. Digestion of food takes place by the action of HCl and gastric juices secreted from the walls of the stomach. Partially digested food called chyme is passed from stomach to the first part of the small intestine, the duodenum. The duodenum receives bile from gall bladder and pancreatic juices from the pancreas through a common bile duct. Bile emulsifies fat and pancreatic juices digest carbohydrates and proteins. Final digestion takes place in the intestine. Digested food is absorbed by the numerous finger-like folds in the inner wall of intestine called villi and microvilli. The undigested solid waste moves into the rectum and passes out through cloaca.

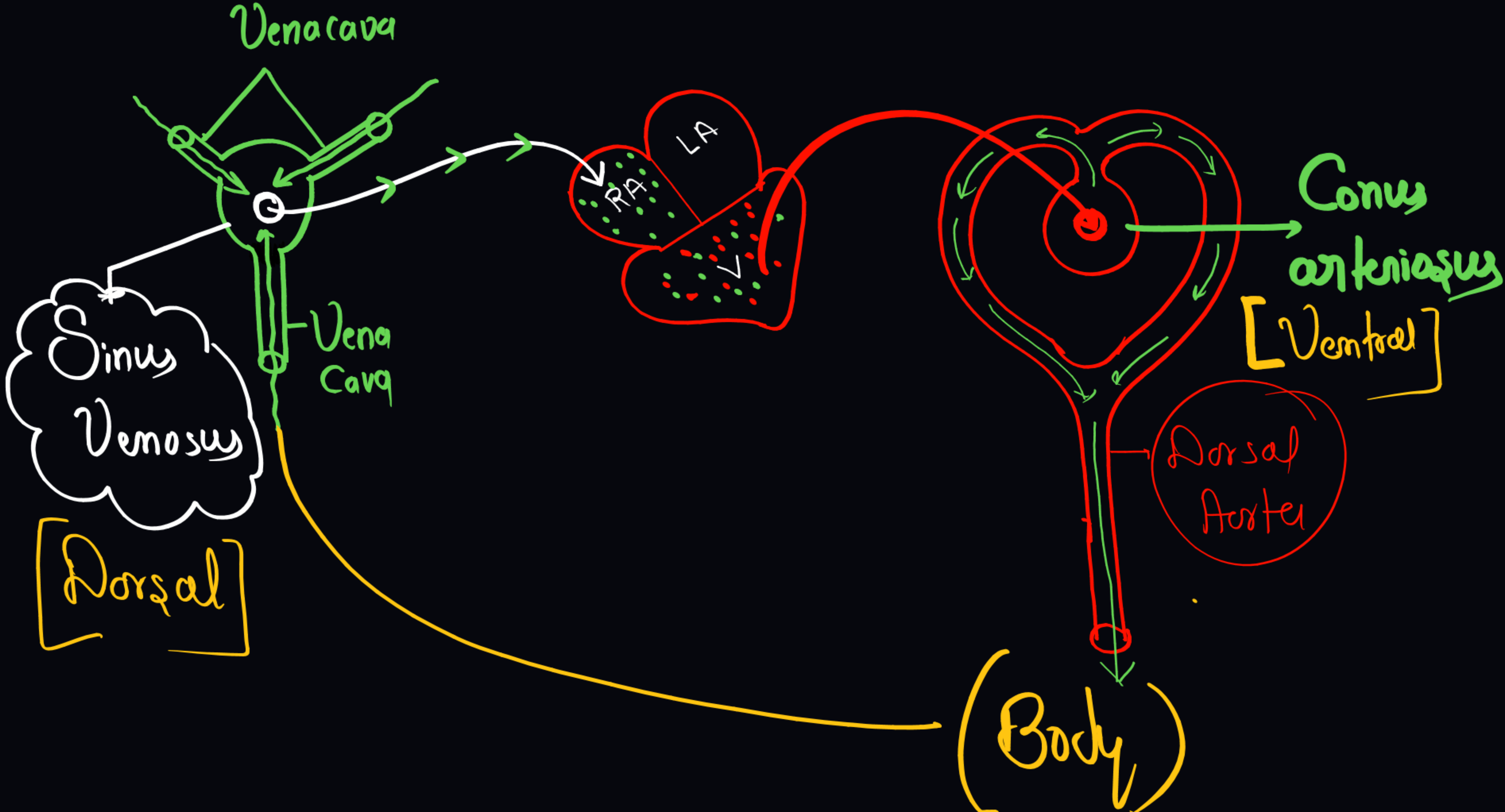
Respiratory System



Frogs respire on land and in the water by two different methods. In water, skin acts as aquatic respiratory organ (cutaneous respiration). Dissolved oxygen in the water is exchanged through the skin by diffusion. On land, the buccal cavity, skin and lungs act as the respiratory organs. The respiration by lungs is called pulmonary respiration. The lungs are a pair of elongated, pink coloured sac-like structures present in the upper part of the trunk region (thorax). Air enters through the nostrils into the buccal cavity and then to lungs. During aestivation and hibernation gaseous exchange takes place through skin.

Circulatory System (Closed Circulatory System) → @

- → Heart = Myogenic - 3-Chambered [2A + 1V] → additional Chamber
  - Sinus Venosus
  - +
  - Conus arteriosus
- → Blood ⟹
  - Respiratory Pig = H.b. +nt
  - R.b.C with Nucleus.
  - Lymph Without = R.B.C + Protein.
- → Blood Vessels
  - Artery
  - Vein
  - Capillary
  - → Portal Vein



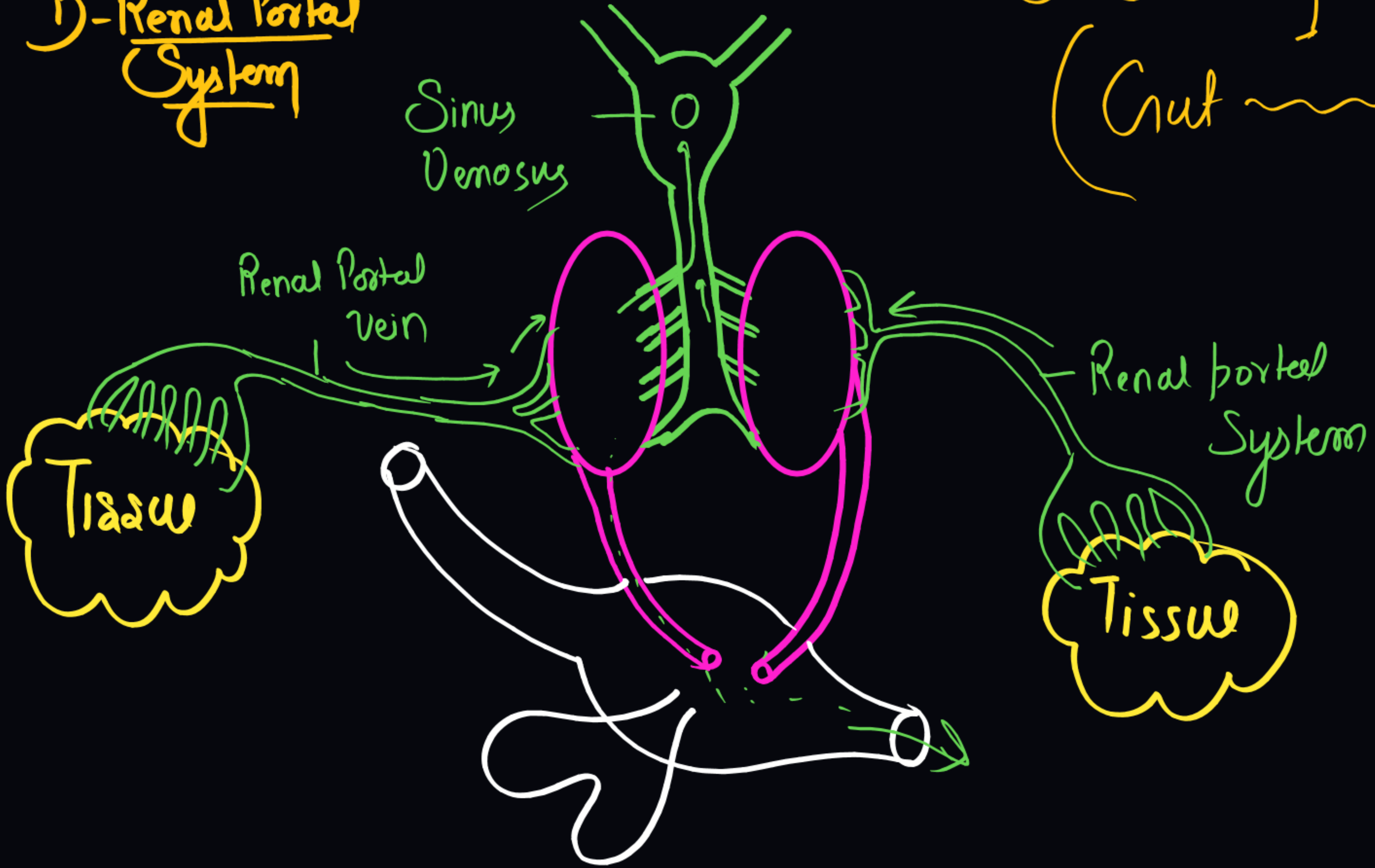
Venacava
LA
RA
V
Conus arteriosus
[Ventral]
Dorsal Aorta
Sinus Venosus
Vena Cava
[Dorsal]
Body

Portal System

1) - Renal Portal System

2) Hepatic Portal System

(Gut → Liver)



The vascular system of frog is well-developed closed type. Frogs have a lymphatic system also. The blood vascular system involves heart, blood vessels and blood. The lymphatic system consists of lymph, lymph channels and lymph nodes. Heart is a muscular structure situated in the upper part of the body cavity. It has three chambers, two atria and one ventricle and is covered by a membrane called pericardium. A triangular
ventricle and is covered by a membrane called pericardium. A triangular
structure called sinus venosus joins the right atrium. It receives blood through the major veins called vena cava. The ventricle opens into a sac-like conus arteriosus on the ventral side of the heart. The blood from the

heart is carried to all parts of the body by the arteries (arterial system). The veins collect blood from different parts of body to the heart and form the venous system. Special venous connection between liver and intestine as well as the kidney and lower parts of the body are present in frogs. The former is called hepatic portal system and the latter is called renal portal system. The blood is composed of plasma and cells. The blood cells are RBC (red blood cells) or erythrocytes, WBC (white blood cells) or leucocytes and platelets. RBC's are nucleated and contain red coloured pigment namely haemoglobin. The lymph is different from blood. It lacks few proteins and RBCs. The blood carries nutrients, gases and water to the respective sites during the circulation. The circulation of blood is achieved by the pumping action of the muscular heart.

Excretory System

- Excretory Organ = Kidney
- Ex. Sub. = Urea

[Ureotelic]

The elimination of nitrogenous wastes is carried out by a well developed excretory system. The excretory system consists of a pair of kidneys, ureters, cloaca and urinary bladder. These are compact, dark red and bean like structures situated a little posteriorly in the body cavity on both sides of vertebral column. Each kidney is composed of several structural and functional units called uriniferous tubules or nephrons. Two ureters emerge from the kidneys in the male frogs. The ureters act as urinogenital duct which opens into the cloaca. In females the ureters and viduct open seperately in the cloaca. The thin-walled urinary bladder is resent ventral to the rectum which also opens in the cloaca. The frog xcretes urea and thus is a **ureotelic** animal. Excretory wastes are carried y blood into the kidney where it is separated and excreted.

Endocrine System

The system for control and coordination is highly evolved in the frog. It includes both neural system and endocrine glands. The chemical coordination of various organs of the body is achieved by hormones which are secreted by the endocrine glands. The prominent endocrine glands found in frog are pituitary, thyroid, parathyroid, thymus, pineal body, pancreatic islets, adrenals and gonads. The nervous system

Nervous System

islets, adrenals and gonads. The nervous system is organised into a central nervous system (brain and spinal cord), a peripheral nervous system (cranial and spinal nerves) and an autonomic nervous system (sympathetic and parasympathetic). There are ten pairs of cranial nerves arising from the brain. Brain is enclosed in a bony structure called brain box (cranium). The brain is divided into fore-brain, mid-brain and hind-brain. Forebrain includes olfactory lobes, paired cerebral hemispheres and unpaired diencephalon. The midbrain is characterised by a pair of optic lobes. Hind-brain consists of cerebellum and medulla oblongata. The medulla oblongata passes out through the foramen magnum and continues into spinal cord, which is enclosed in the vertebral column.

Nervous System

1)- C.N.S. = Brain + Spinal cord

2)- P.N.S. = Cranial Nerve (10-pairs) + Spinal Nerve (10-pairs)

- S.N.S (Voluntary)
- A.N.S. (Involunta.)
  - Sympathatic
  - Parasympa.

Sensory Organs

Frog has different types of sense organs, namely organs of touch (sensory papillae), taste (taste buds), smell (nasal epithelium), vision (eyes) and hearing (tympanum with internal ears). Out of these, eyes and internal ears are well-organised structures and the rest are cellular aggregations around nerve endings. Eyes in a frog are a pair of spherical structures situated in the orbit in skull. These are simple eyes (possessing only one unit). External ear is absent in frogs and only tympanum can be seen externally. The ear is an organ of hearing as well as balancing (equilibrium).

Male Reproductive System

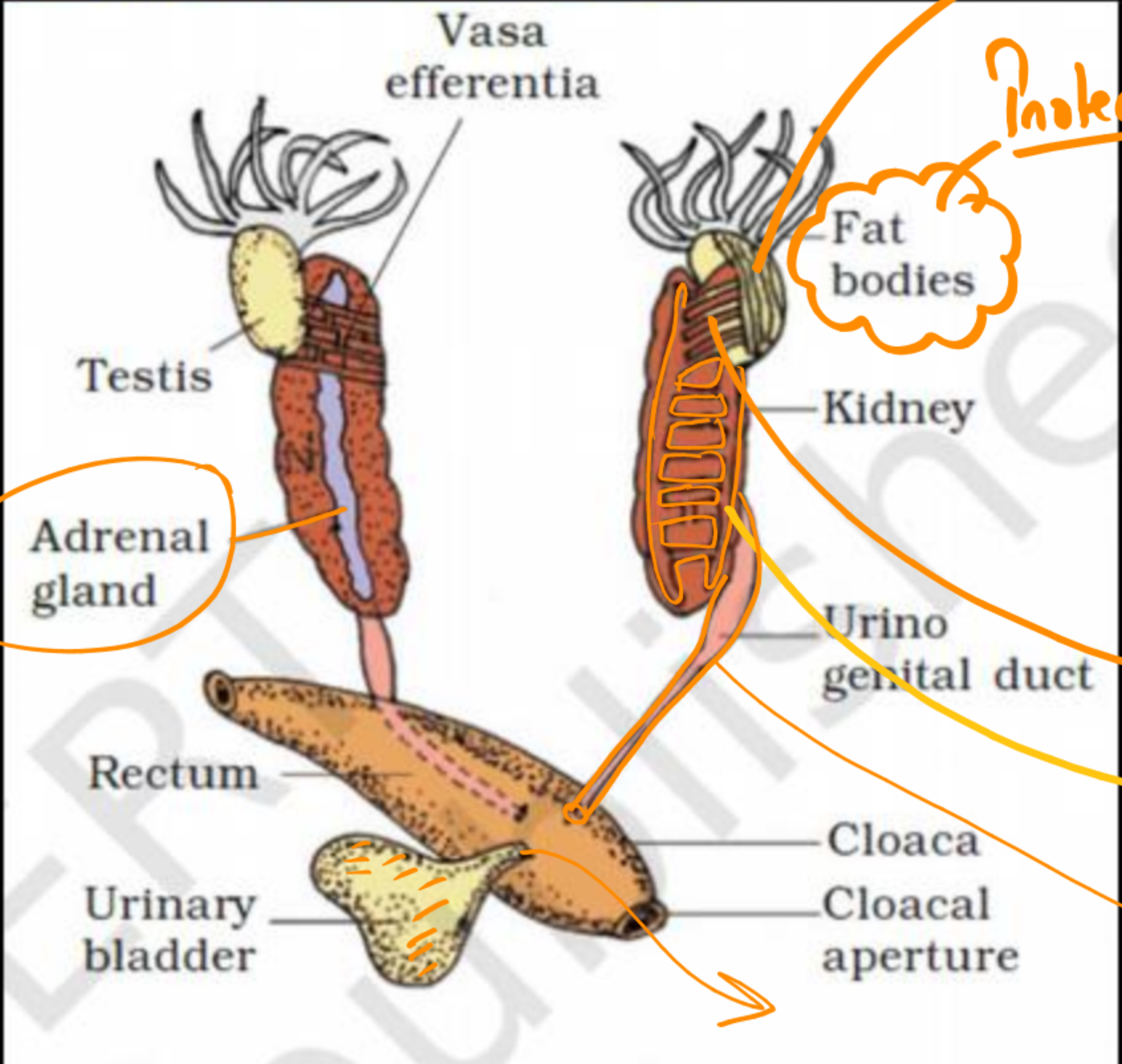


Figure 7.3 Male reproductive system

Testis – One pair, tnt on Kidney
→ Attach with Kidney by = Double fold of Peritonium [Mesorchium]
→ Seminiferous Tubules [Spermatogenesis]
↓
Vasa efferentia [10-12]
↓
Bidder's Canals
↓
Urinogenital Duct → Rectum → Cloaca

Frogs have well organised male and female reproductive systems. Male reproductive organs consist of a pair of yellowish ovoid testes (Figure 7.3), which are found adhered to the upper part of kidneys by a double fold of peritoneum called mesorchium. Vasa efferentia are 10-12 in number that arise from testes. They enter the kidneys on their side and open into Bidder's canal. Finally it communicates with the urinogenital duct that comes out of the kidneys and opens into the cloaca. The cloaca is a small, median chamber that is used to pass faecal matter, urine and sperms to the exterior.

Female Reproductive System

The female reproductive organs include a pair of ovaries (Figure 7.4). The ovaries are situated near kidneys and there is no functional connection with kidneys. A pair of oviduct arising from the ovaries opens into the cloaca separately. A mature female can lay 2500 to 3000 ova at a time. Fertilisation is external and takes place in water. Development involves a larval stage called tadpole. Tadpole undergoes metamorphosis to form the adult.

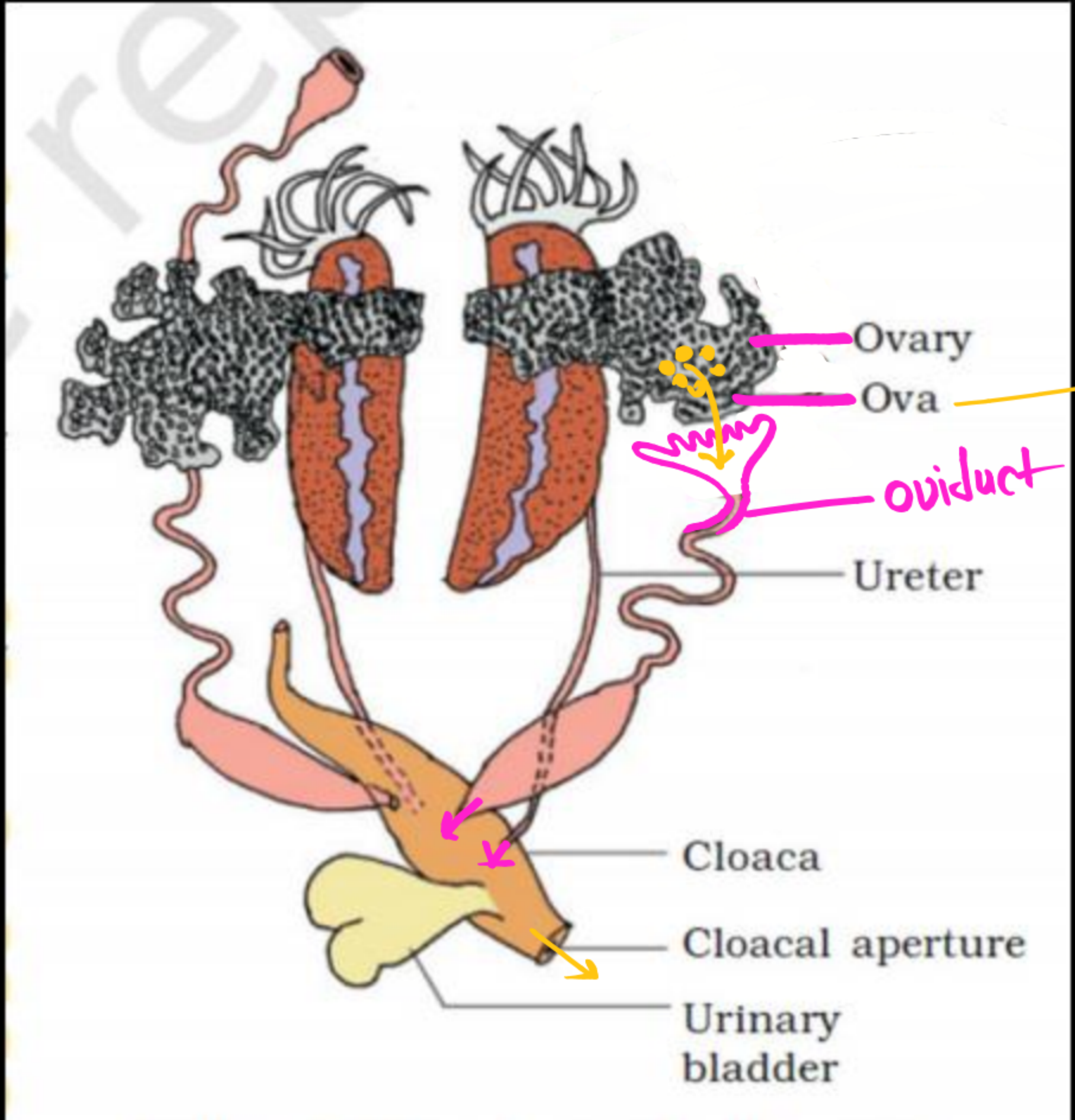


Figure 7.4 Female reproductive system

→ 2500 – 3000 ova

Fertilization = External in water

Metamorphosis = Larva → Adult

Frogs are beneficial for mankind because they eat insects and protect the crop. Frogs maintain ecological balance because these serve as an important link of food chain and food web in the ecosystem. In some countries the muscular legs of frog are used as food by man.

Q. Which of these statement is true about frog?

(A) It lives both on land and in sea water

(B) They cannot survive in freshwater

(C) Rana tigrine is a rare species

(D) They belong to class Amphibia

Q. Frog is

(A) Homoeothermic
(B) Poikilothermic
(C) Homeostatic
(D) Warm-blooded



Q. Which of these methods are utilized by frogs for protection?

(A) Speed
(B) Spikes
(C) Mimicry
(D) Playing dead

Q. Which of these structures protects the eyes of the frog in water?

(A) Nictitating membrane

(B) Tympanum

(C) Bidder's canal

(D) Cloaca



Q. The chief nitrogenous waste material present in the urine of frog

(A) Urea

(B) Uric acid

(C) Ammonia

(D) Allantois

Q. Which of these structures in frog receive sound signals?

(A) Webbed feet

(B) Skin

(C) Nictitating membrane

(D) Tympanum

Q. Male frogs can be distinguished from female frogs by the presence of

(A) Sound producing vocal sacs

(B) Copulatory pad

(C) Pair of nostrils

(D) Both (A) and (B)

Q. How many ova are laid by a female frog at a time?

(A) 100-200

(B) 500-1000

(C) 2500-3000

(D) 5000-6000



Q. Where are the copulatory pads in male frog present?

(A) Second digit of the hindlimbs

(B) First digit of the hindlimbs

(C) First digit of the forelimbs

(D) Second digit of the forelimbs



Q. Frog is

(A) Oviparous

(B) Ovoviviparous

(C) Viviparous

(D) None

Q. Respiratory organs of frog are:

(A) Skin

(B) Lungs

(C) Both (A) and (B)

(D) Flame cells

Q. Frogs have the ability to change the colour to hide them from their enemies. This protective coloration is called

(A) Aestivation

(B) Metamorphosis

(C) camouflage

(D) Metagenesis

Q. In frog, the duodenum receives bile from gall bladder and pancreatic juices from the pancreas through a

(A) Common bile duct
(B) Hepato-pancreatic duct
(C) Cystic duct
(D) Hepatic duct



Q. During the peak summer and winter the frogs take shelter in deep burrows to protect them from extreme heat and cold. This is called as

(A) Summer sleep (aestivation) and winter sleep (hibernation)

(B) Summer sleep (hibernation) and winter sleep (aestivation)

(C) Summer sleep (diapause) and winter sleep (suspend)

(D) Summer sleep (dormancy) and winter sleep (diapause)

Q. In water, the aquatic respiratory organ(s) of frog is/are

(A) Skin (cutaneous respiration)
(B) Skin, lungs (pulmonary respiration) and buccal cavity
(C) Lungs and buccal cavity
(D) Skin and buccal cavity



Q. Read the following statements and find out the incorrect statement about frogs.

(A) Frog respire on land and in water by two different methods.

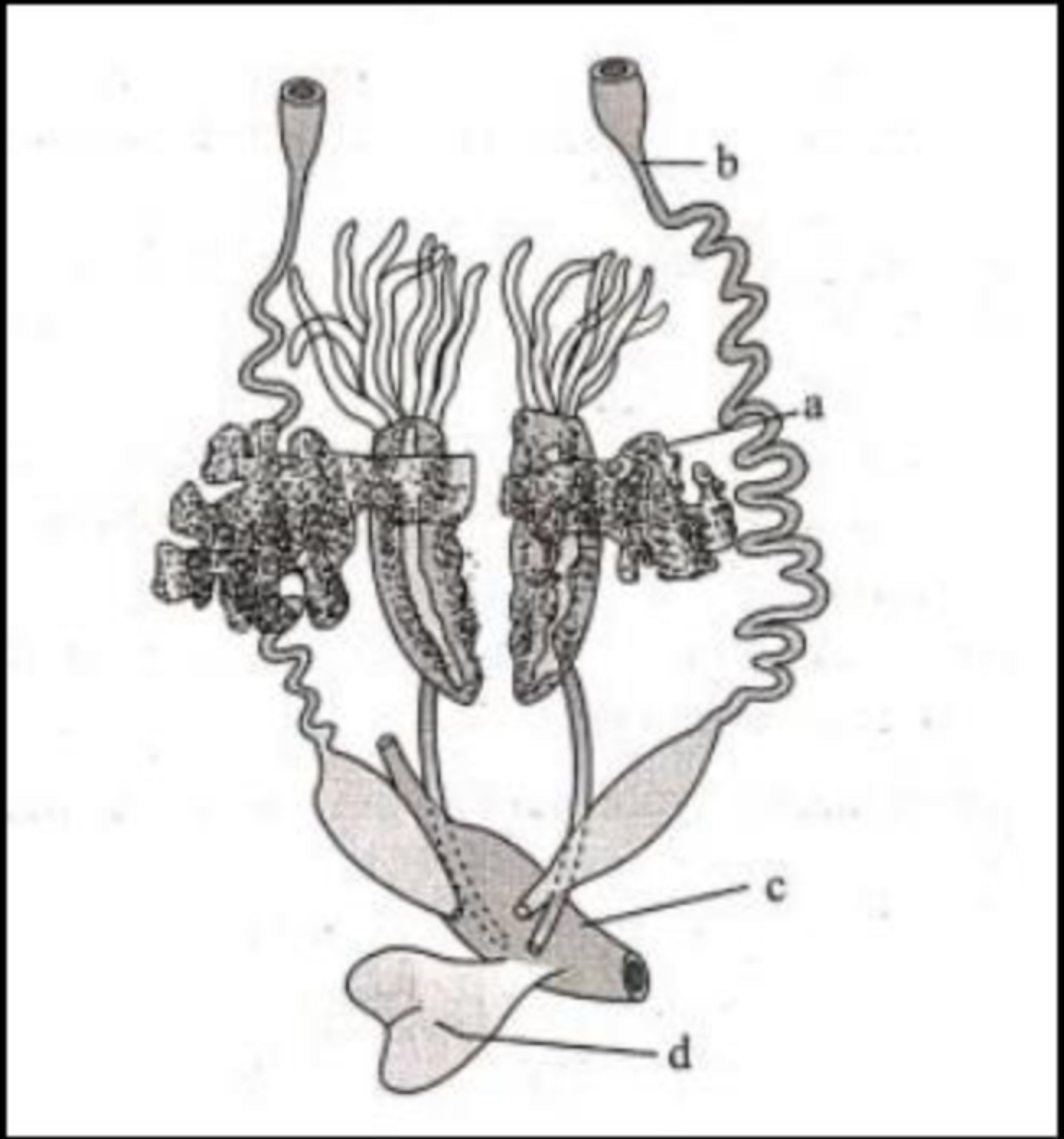
(B) Liver secrets bile that is stored in the gall bladder.

(C) Three chambered heart is situated in the upper part of body cavity.

(D) RBCs Are enucleated and contain red coloured pigment called haemoglobin.

Q. Recognise the figure and find out the correct matching.

(A) a-cloaca, b-ovary, d-oviduct, c-urinary bladder
(B) c-cloaca, a-ovary, b-oviduct, d-urinary bladder
(C) b-cloaca, d-ovary, c-oviduct, a-urinary bladder
(D) d-cloaca, c-ovary, a-oviduct, b-urinary blader





Q. A triangular structure that joins the right atrium of heart in frog is called

(A) Sinus venosus and receives blood from vena cava
(B) Conus arteriosus and receives blood from vena cave
(C) Sinus venosus and receives blood from pulmonary artery
(D) Conus arteriosus and receives blood from pulmonary vein.



Q. Read the following statements and find out the incorrect statement about frog.

(A) Frog never drinks water.

(B) In frog, neck and tail are absent.

(C) The duodenum receives bile from gall blader and pancreatic juices from the pancreas through the hepato-pancreatic duct.

(D) Eyes of frog are covered by nictitating membrane that protects them while in water.

Q. The nervous system of frog is organized into

(A) Central nervous system and peripheral nervous system

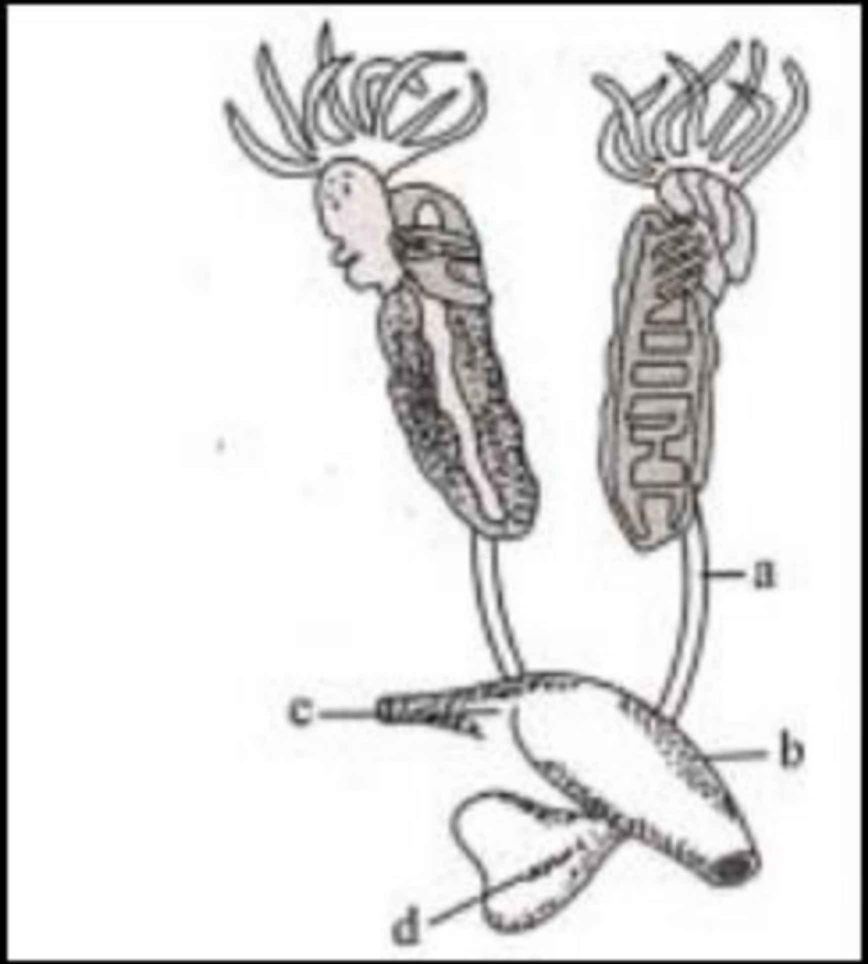
(B) Central nervous system and autonomic nervous system

(C) Central nervous system, peripheral nervous system and autonomic nervous system

(D) Brain and spinal cord

Q. Recognise the figure and find out the correct matching.

(A) a- cloaca, b-rectum, c-urinary bladder, d-urino genital duct
(B) c-cloaca, d-rectum, a-urinary bladder, b-urino-genital duct
(C) b-cloaca, c-rectum, d-urinary blader, a-urino-genital duct
(D) d-cloaca, a-rectum, b-urinary bladder, c-urino-genital duct



Q. Central nervous system is divided in frog in

(A) Brain and spinal cord

(B) Cranial and spinal nerves

(C) Sympathetic and parasympathetic

(D) Forebrain, midbrain and hindbrain

Q. Autonomic nervous system in frog is divided into

(A) Brain and spinal cord

(B) Cranial and spinal nerves

(C) Sympathetic and parasympathetic

(D) Forebrain, midbrain and hindbrain

Q. In male frog, vasa efferentia enter the kidney and open into

(A) Ureter
(B) Urinogenital duct
(C) Cloaca
(D) Bidder's canal

Q. Frogs are

(A) Herbivorous

(B) Carnivorous

(C) Producers

(D) Decomposers

Q. The liquefied semi-digested acidic food is known as

(A) Bile
(B) Bolus
(C) Chyme
(D) Faeces



Q. Alimentary canal in frog terminates into

(A) Rectum
(B) Cloaca
(C) Ileum
(D) Duodenum



Q. Pancreatic juice helps in digestion of

(A) Fats
(B) Carbohydrates
(C) Protein
(D) All of these

Q. In frogs, urine is temporarily stored in

(A) Kidneys
(B) Urinary bladder
(C) Ureters
(D) Cloaca

THANK YOU !!

MANTHAN NEET

HUMAN REPRODUCTION

LECTURE - 1

ZOOLOGY

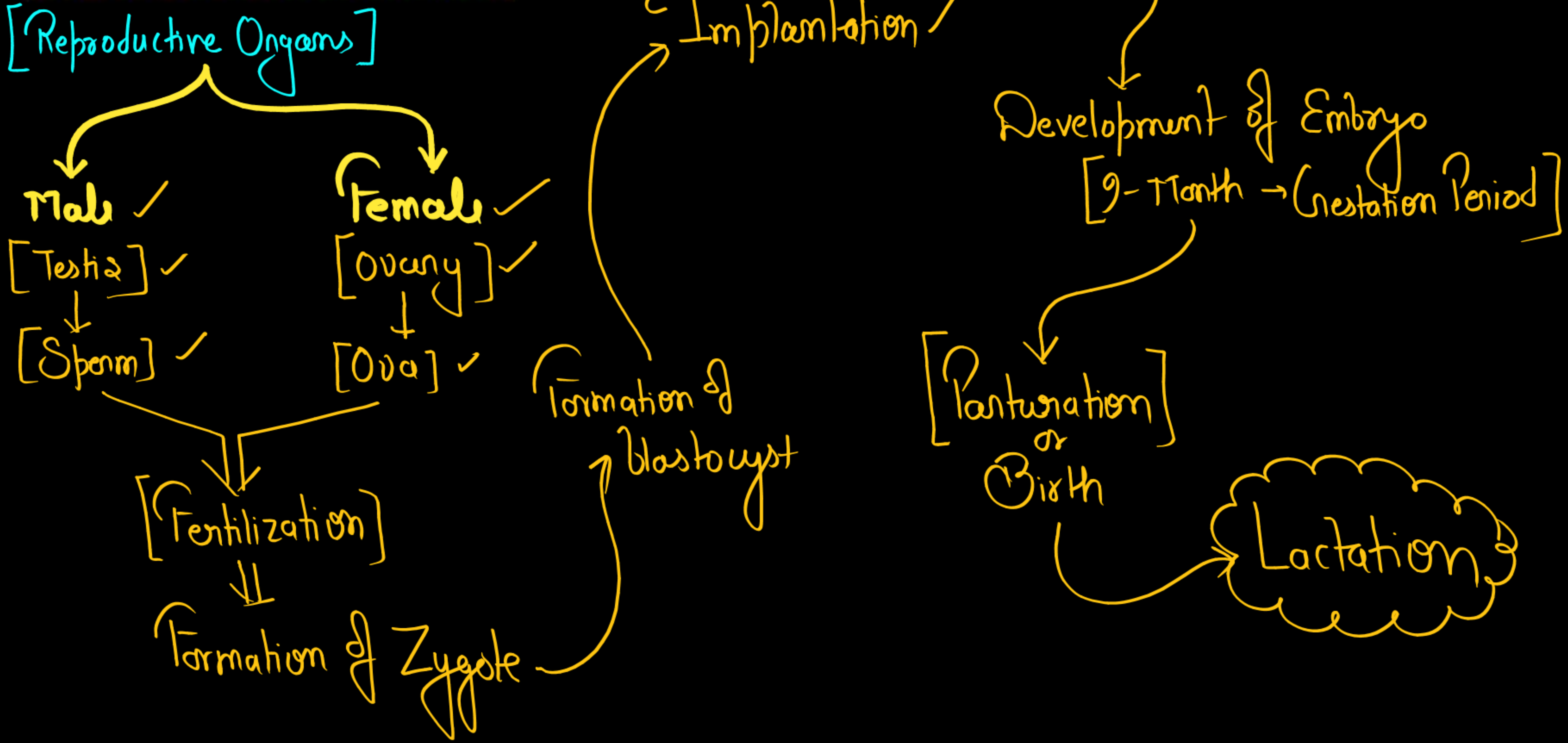


MD SIR

TODAY'S GOAL

- Types of Sex Organ in Human
- Male Reproductive System
- Testis

HUMAN REPRODUCTION



TYPES OF SEX ORGAN IN HUMAN

[Pri. Sex Organs]

- Secretion of Sex Hormones
- Gametogenesis

eg
- (Male) → (Testis)
- (Female) → (Ovaries)

Sec. Sex Organs.

- Maturation of gametes.
- Transportation of gametes.

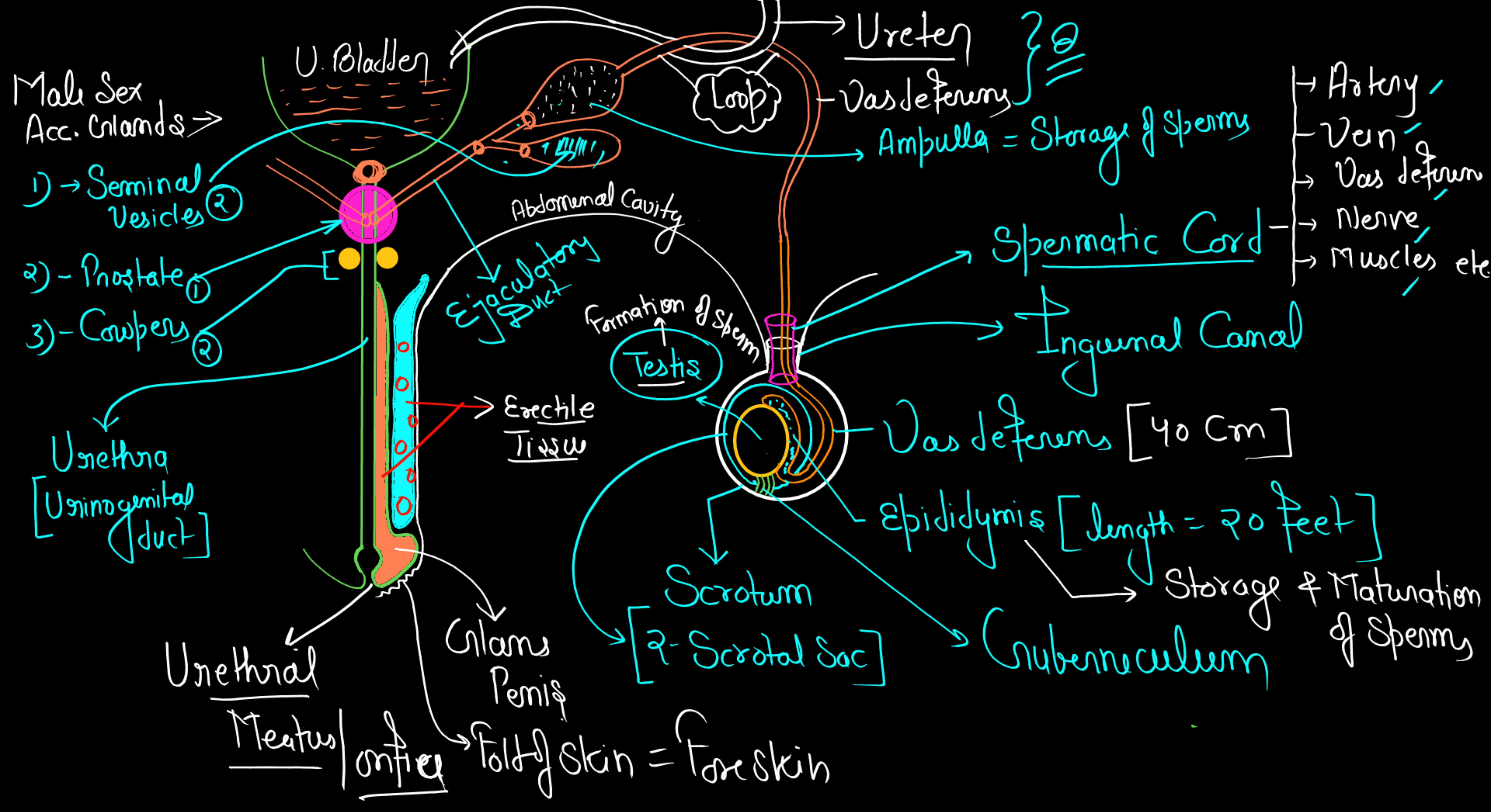
eg
- Male
  - Epididymis
  - Vas deferens
  - etc.
- Female.
  - Fallopian Tube
  - Uterus
  - Cervix etc.

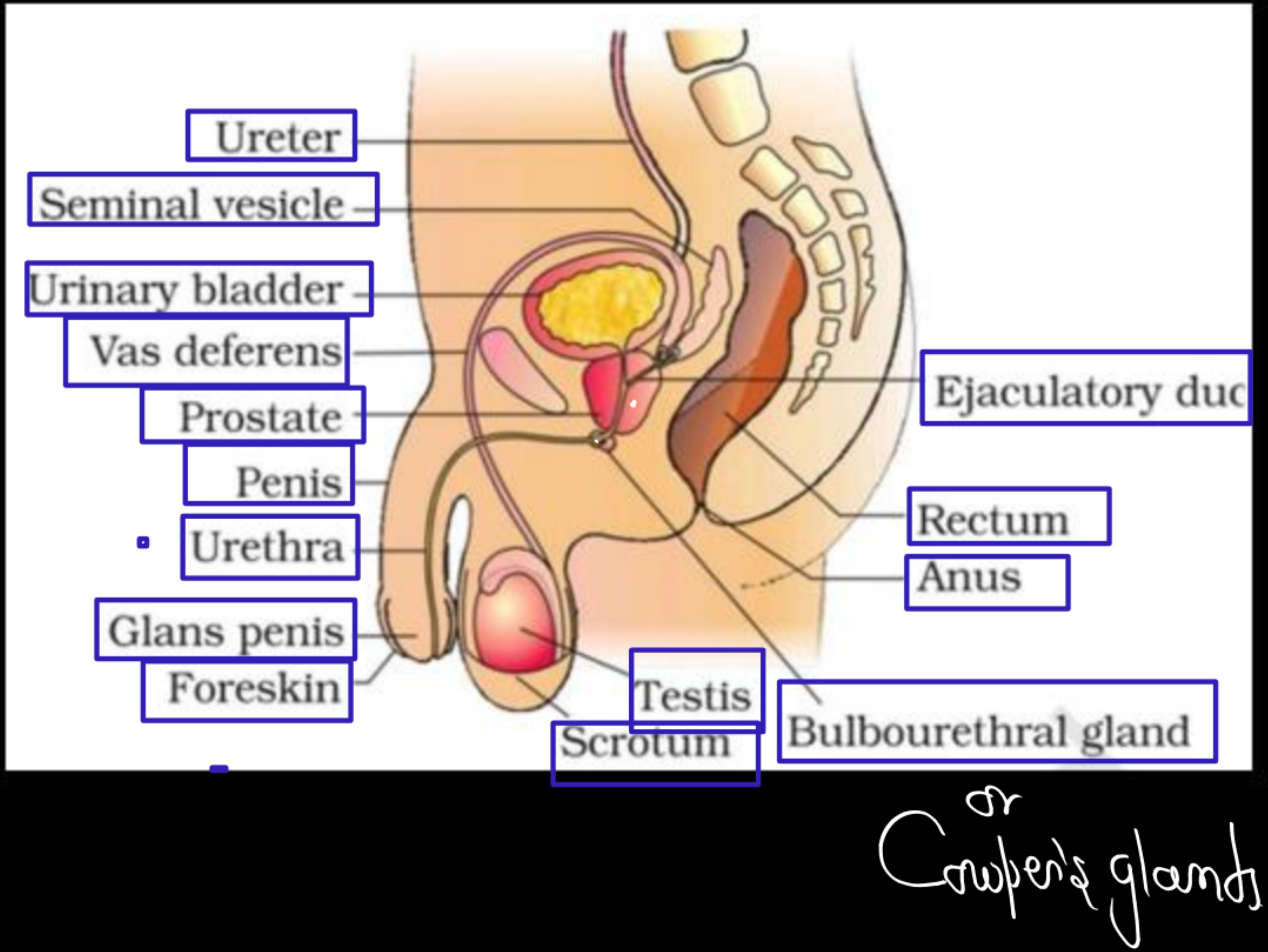
MALE REPRODUCTIVE SYSTEM

The male reproductive system is located in the pelvis region.

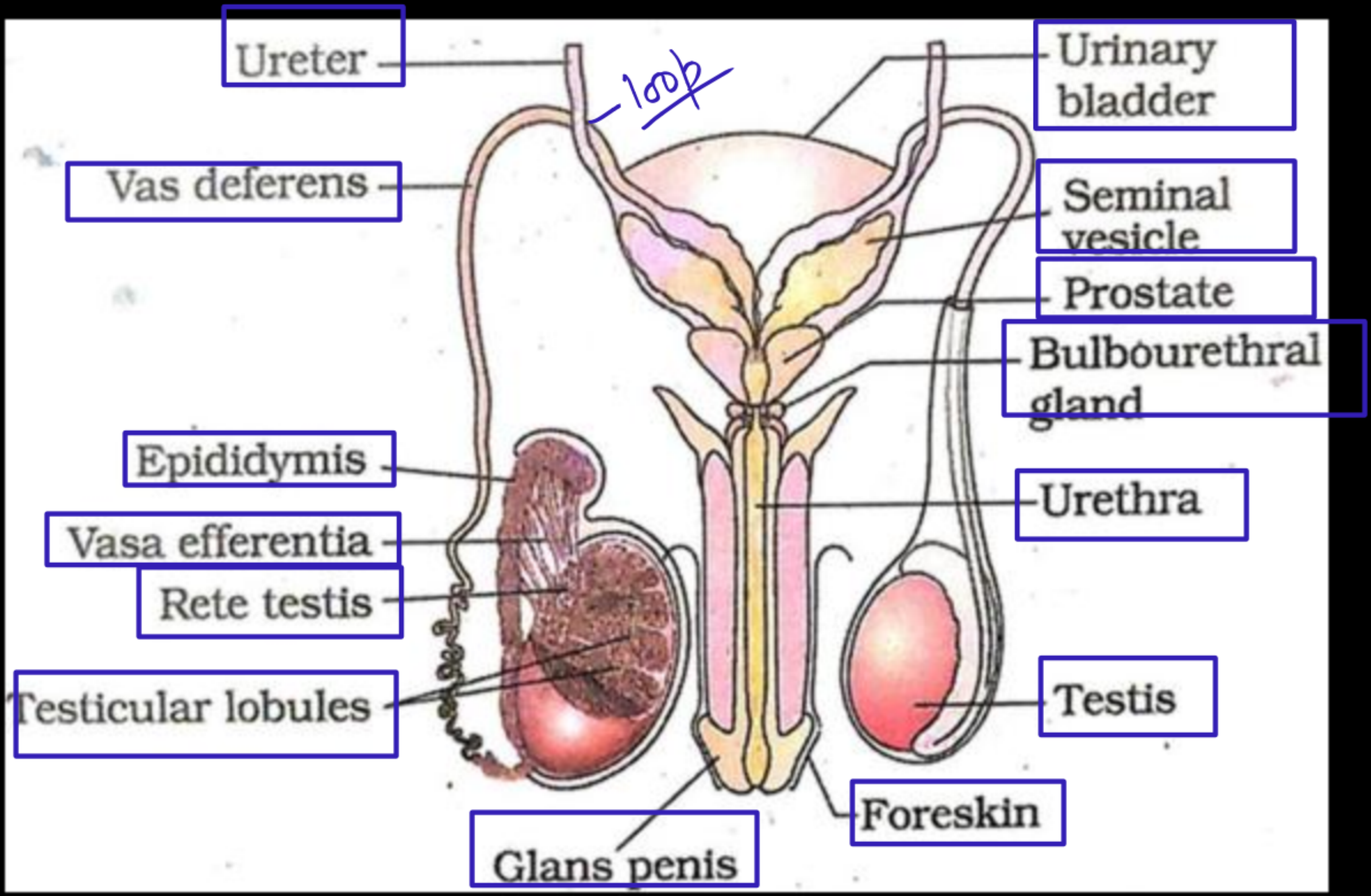
It includes

- A pair of testes → Pri sex Organ
- Accessory ducts → Rete Testis, Vasa efferentia, Epididymis, Vas deferens.
- Accessory glands →
  - Prostate = Single
  - Seminal Vesicles = one pair
  - Cowper's glands = one pair.
- External genitalia
  - Scrotum
  - Penis.


Male Sex Acc. Glands →
1) → Seminal Vesicles (2)
2) - Prostate (1)
3) - Cowpers (2)
U. Bladder
Ureter
Loop
Vas deferens
Ampulla = Storage of Sperms
Artery
Vein
Vas deferens
Nerve
Muscles etc
Spermatic Cord
Abdominal Cavity
Ejaculatory Duct
Formation of Sperm
Testis
Inguinal Canal
Erectile Tissue
Vas deferens [40 Cm]
Urethra [Urinogenital duct]
Epididymis [Length = 20 feet]
Storage & Maturation of Sperms
Scrotum [2- Scrotal Sac]
Gubernaculum
Glans Penis
Urethral Meatus | orifice
Fold of Skin = Foreskin



Ureter
Seminal vesicle
Urinary bladder
Vas deferens
Prostate
Penis
Urethra
Glans penis
Foreskin
Ejaculatory duc
Rectum
Anus
Testis
Scrotum
Bulbourethral gland
or
Cowper's glands


Ureter
loop
Urinary bladder
Vas deferens
Seminal vesicle
Prostate
Bulbourethral gland
Epididymis
Vasa efferentia
Rete testis
Urethra
Testicular lobules
Testis
Foreskin
Glans penis

Testis (One pair- Primary Sex organs)

Origin – Mesodermal,

Oval shaped, Length 4-5 cm, Width 2-3 cm and Weight 14 gm

Position-

- In most of the mammals testis are situated outside the abdominal cavity within a pouch called scrotum (with two scrotal sac) except prototherians, elephant and whale etc.
- The scrotum helps in maintaining the low temperature of the testes (2–2.5°C lower than the normal internal body temperature) necessary for spermatogenesis

Castration (Orchidectomy) –

(Crushing of Testis/Removal of testis)

Castration makes the animal less aggressive (docile) because level of testosterone hormone decreases.

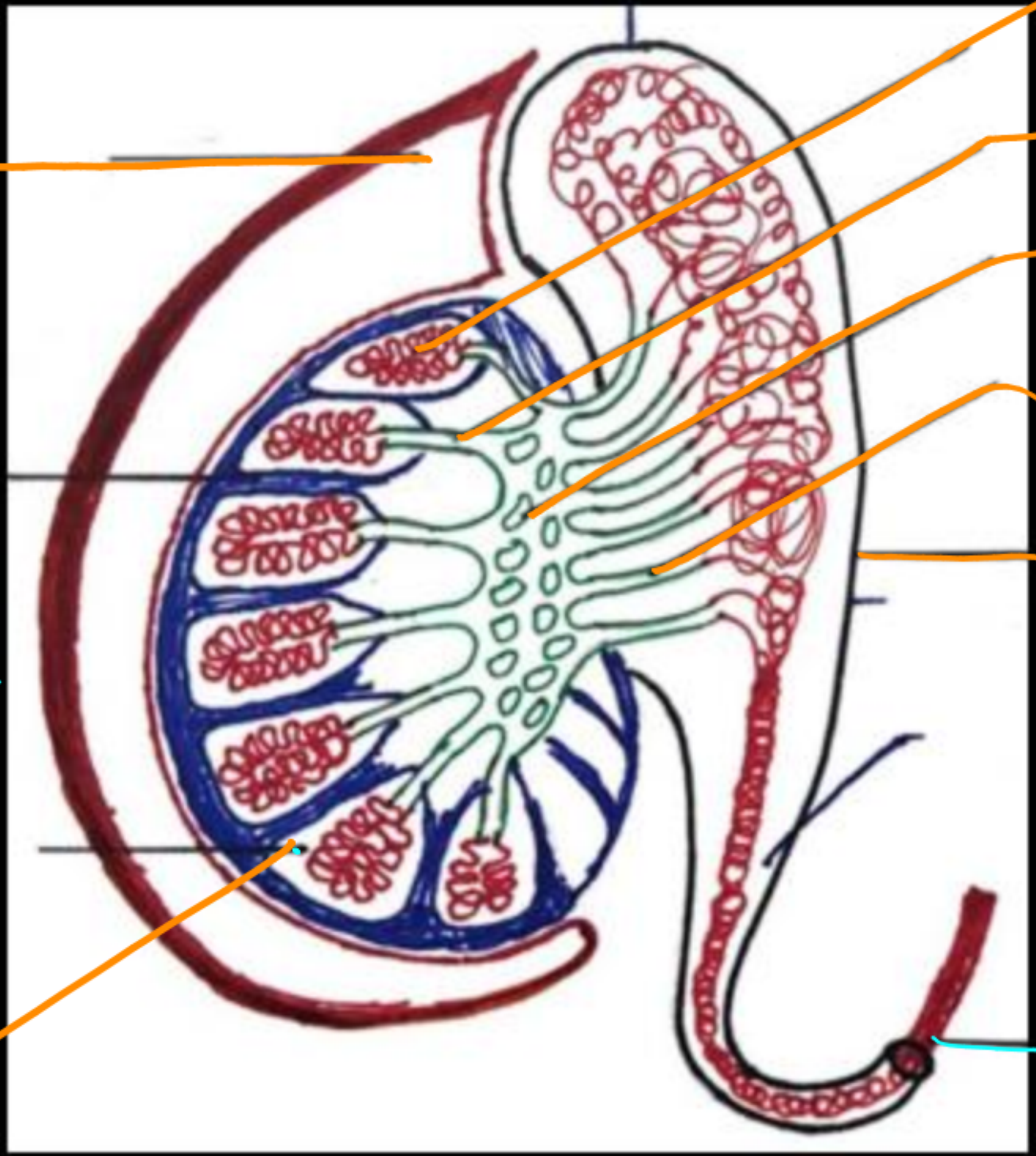
Bull $\xrightarrow{\text{Castration}}$ Bullock (ox)

Internal Structure of Testis

Tunica - Vagenalis
- Outer layer
- Incomplete

Tunica - Albugenia
- Responsible for Formation of Lobules or Compartment — 250 in each Testis

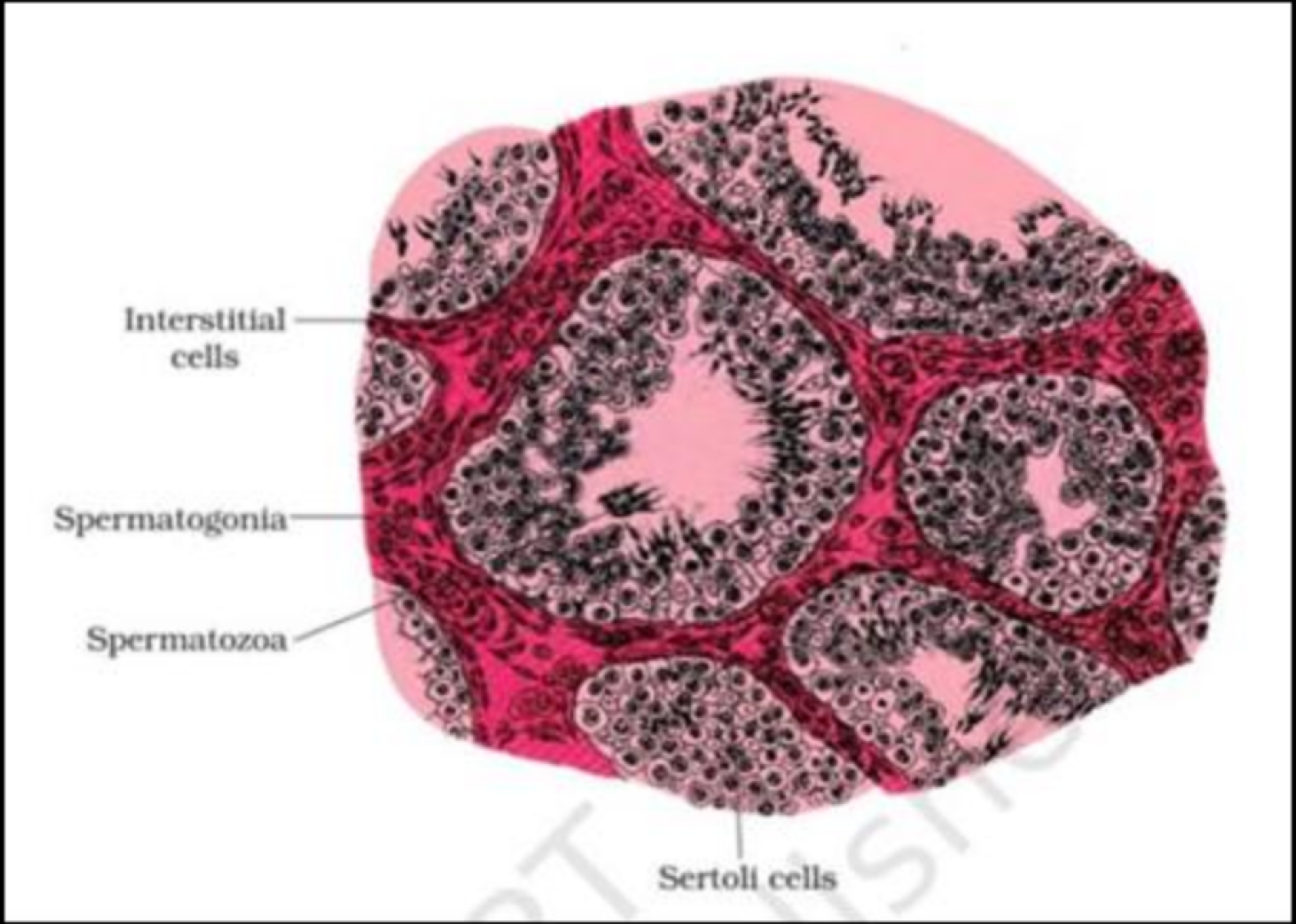
Tunica Vasularis
- Highly Vasular



Spermatogenasis ← **Seminiferous Tubules**
- (1-3) in Each Lobule

Tubuli - Recti
↓
Network of Tubules [Rete Testis]
↓
Vasa Efferentia (10-12)
↓
Epididymis (Coild - Structure)
↓
Vas deferens
↓
Urethra ← Ejaculatory duct

T.S. of Testis from Seminiferous Tubules



Interstitial cells
Spermatogonia
Spermatozoa
Sertoli cells

Urethra –

Length – Male -20cm
Female- 4cm

- In male it is common passage for both urine & semen, called **urinogenital duct**.

- It divided in to-

a) Prostatic urethra (2-3 cm)
b) Membranous (1 cm)
c) Penile (15-17 cm)

External Genitalia

- Scrotum
- Penis

Penis (Male Copulatory Organ)

- The penis is the male external genitalia. It is made up of special tissue that helps in erection of the penis to facilitate insemination.
- The enlarged end of penis called the glans penis is covered by a loose fold of skin called foreskin

THANK YOU !!

MANTHAN NEET

HUMAN REPRODUCTION

LECTURE - 2

ZOOLOGY

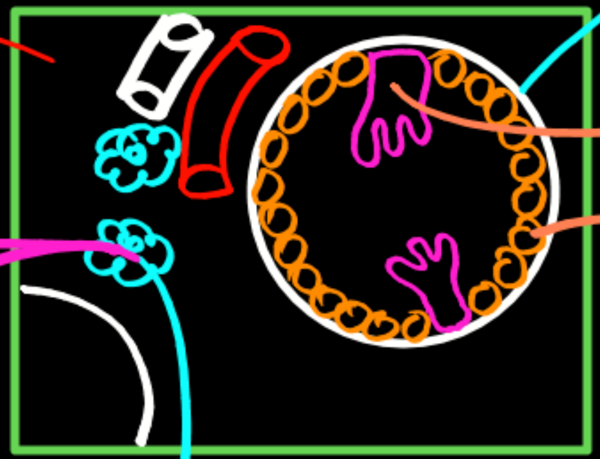


MD SIR

TODAY'S GOAL

- ❑ Testis
- ❑ External genitalia
- ❑ Mechanism of erection and ejaculation
- ❑ Male sex accessory Glands
- ❑ Spermatogenesis

T.S. of Testis from Seminiferous Tubules



[Interstitial Space]

- Leydig cells or Interstitial cells
- Immunological Competant Cells (W.B.C)

Interstitial cells

↓

Androgen [Male Sex Hormone] Testosteron

With ABP

Seminiferous Tubules [1-3]
[Site of Spermatogenasis]

Spermatogonia

↓

Spermatids

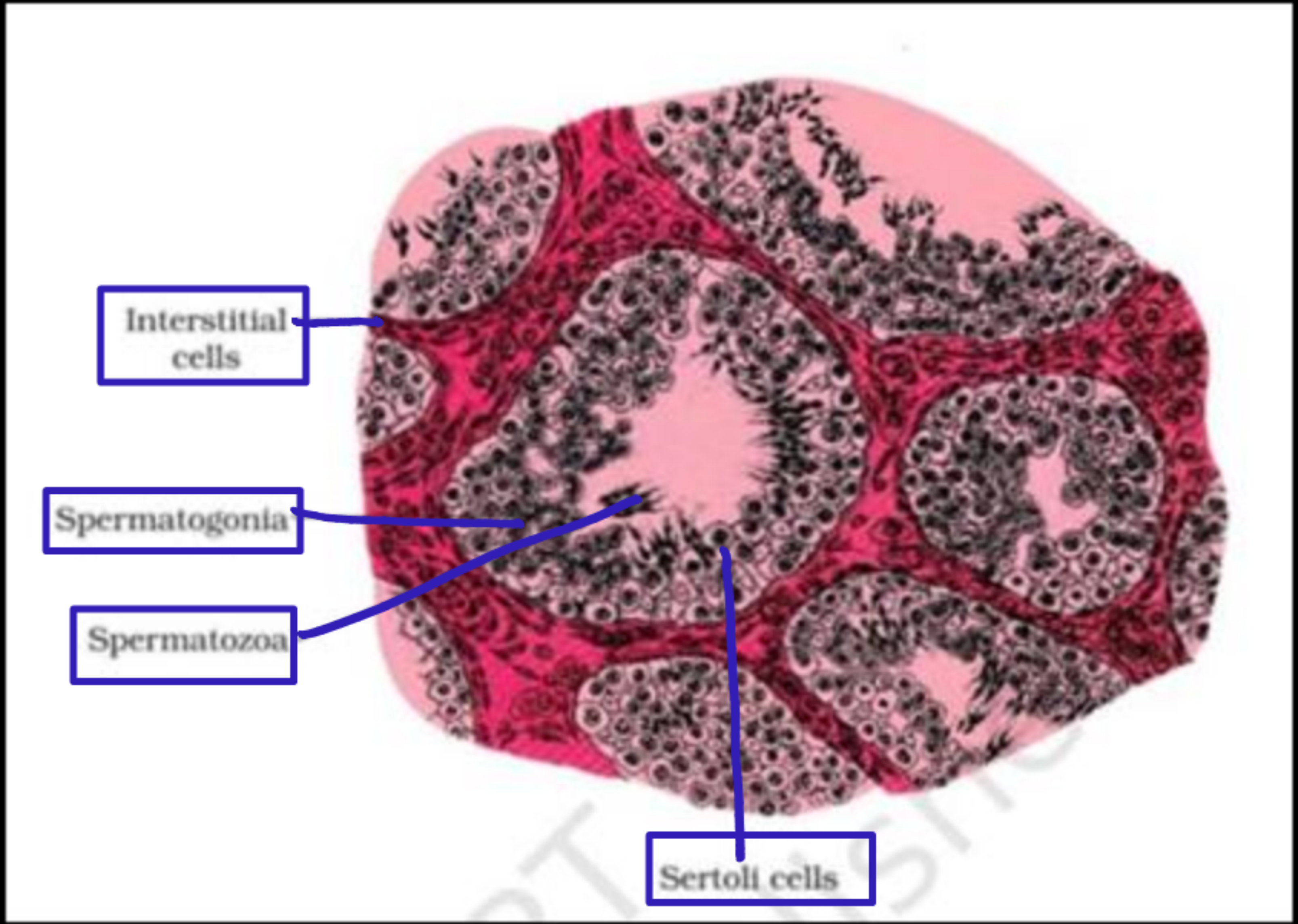
↓

Spermatozoa or Sperms

Sertoli cells

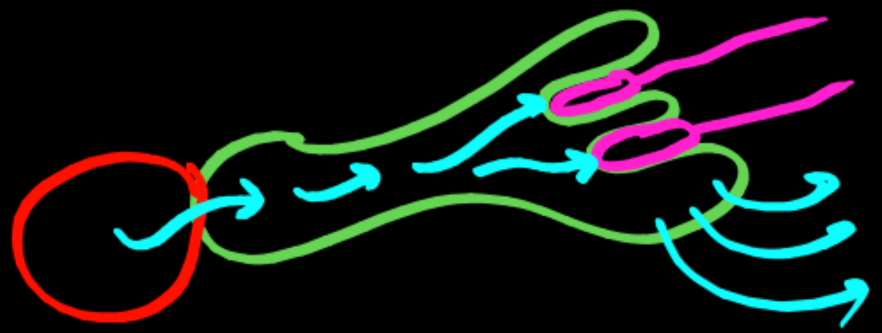
→ ABP

→ Sperm Maturation Factors etc



Interstitial cells
Spermatogonia
Spermatozoa
Sertoli cells

Function of Sertoli Cells-



- These provide structural support, nutrition and protection to developing sperms
- These act as blood - sperm barrier.
- Phagocyte dead & immature sperms
- These secrete-
  - ✓ Androgen Binding Protein(ABP)
  - ✓ Inhibin
  - ✓ Sertoli cells release Sperm maturation factor

External Genitalia

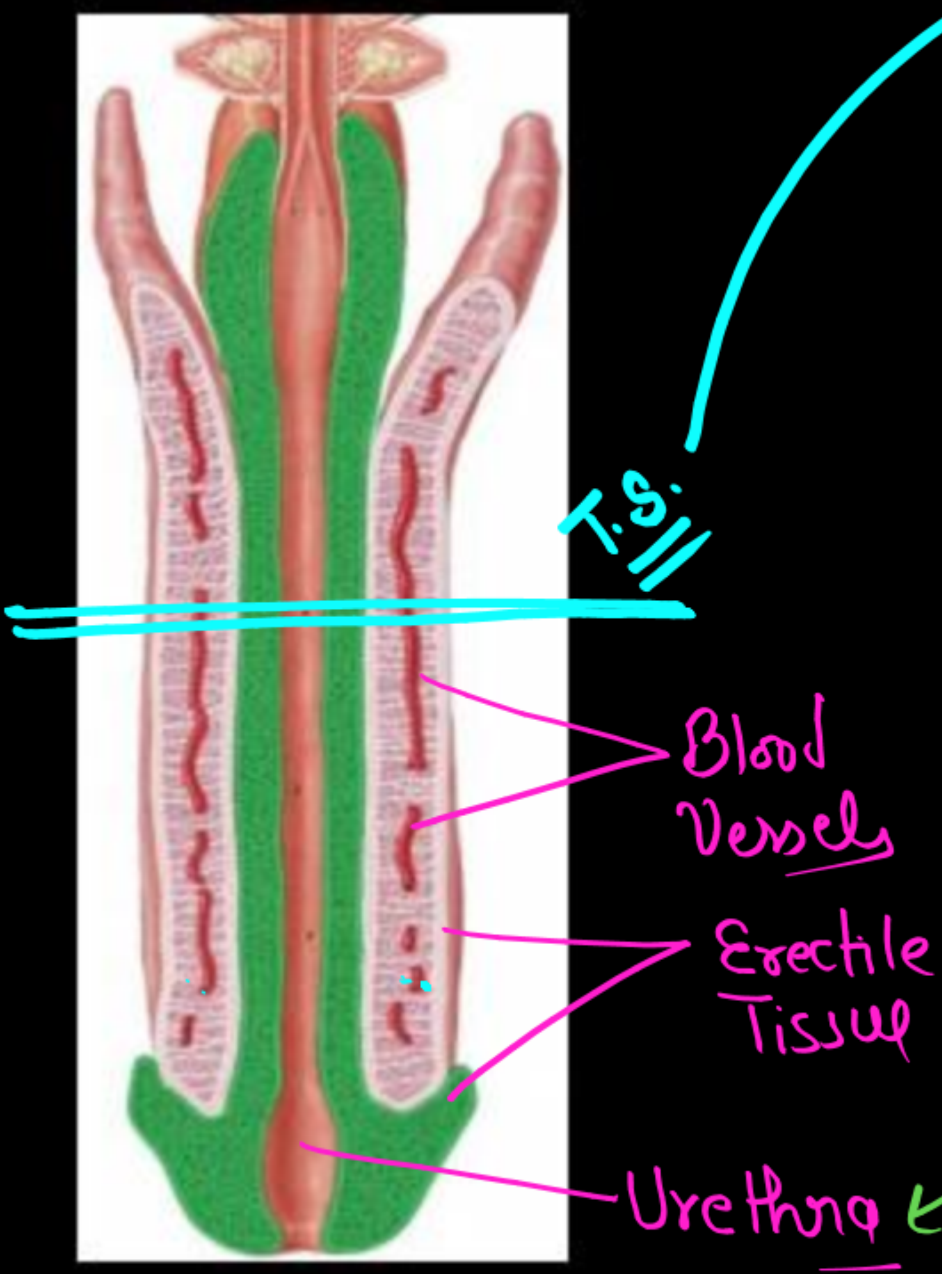
- Scrotum ✓
- Penis ✓

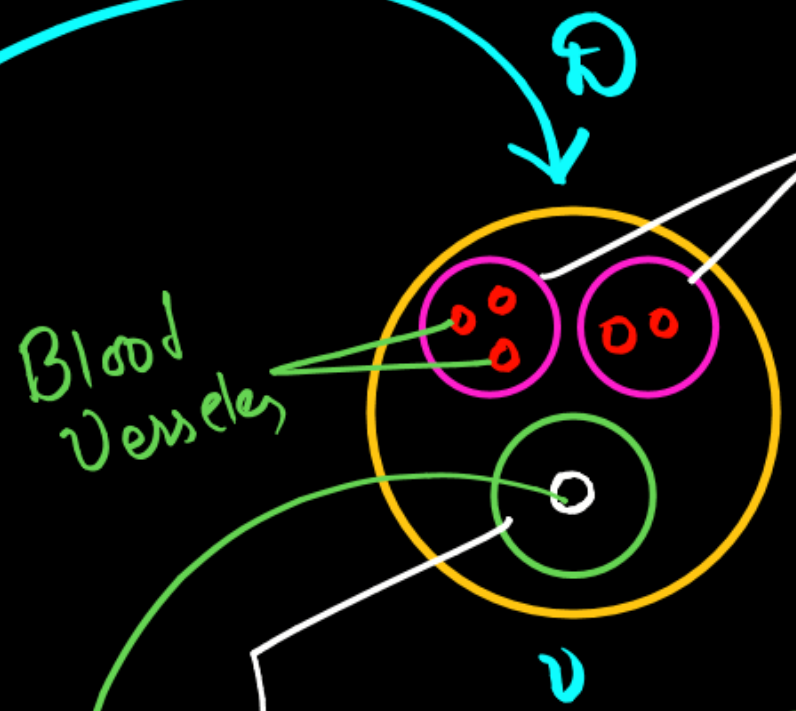
Penis (Male Copulatory Organ)

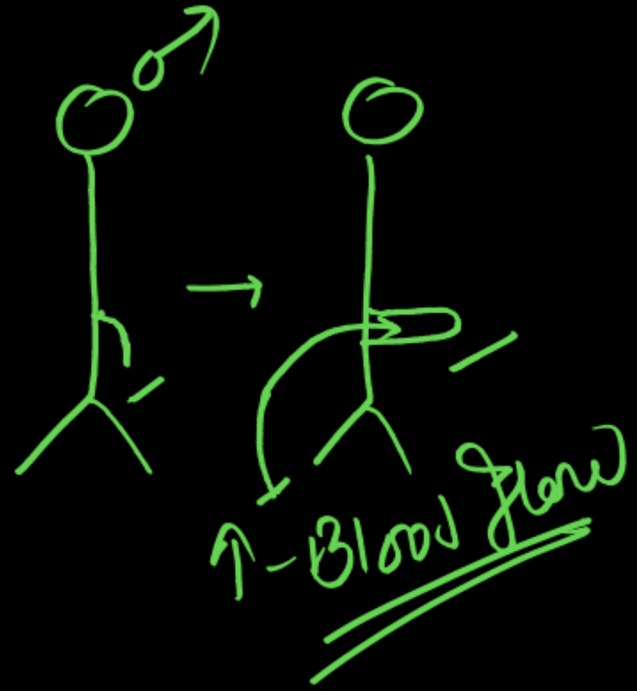
- The penis is the male external genitalia. It is made up of special tissue that helps in erection of the penis to facilitate insemination.
- The enlarged end of penis called the glans penis is covered by a loose fold of skin called foreskin

NCERT

Erectile Tissue → Corpus Cavernosum, Corpus Spongiosum







Corpus Spongiosum

- Position = Mid Ventral
- Single
- tht around urethra
- Convert into glans penis.

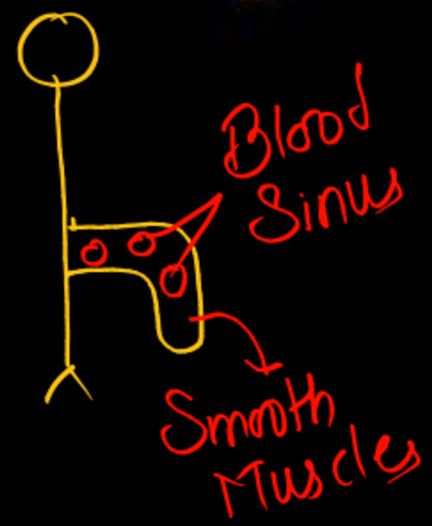
Corpus Cavernosum

CC - Double

- Position = Dorsal
- Double
- tht around blood Vessels

Regulation of Erection and Ejaculation

Sildinafil Citrate Salt → Erectile Dysfunction



C.N.S. = A.N.S.

Parasympathatic

- ↑ Secretion of N.O. in local tissue of Penis → Dilation of Blood Sinus → ↑ Blood flow
- Relaxation of Smooth Muscles of Penis

→ Erection of Penis



Sympathatic

→ Stimulate Contraction in Smooth Muscles of Epididymis, Vasdeferens, Ejaculatory duct etc.

→ Ejaculation

Accessory Glands-

1. Seminal Vesicles = one pair
2. Prostate gland = Single
3. Bulbourethral glands = one pair
   or
   Cowper's glands

(1) Seminal Vesicles (one pair)-

- 60-70% of the volume of semen.
- Seminal fluid is – Alkaline nature (pH 7.4),
- Yellow and Viscous fluid that contains-

◆ Fructose
◆ Prostaglandins (Local hormone)-
◆ Clotting proteins (fibrinogen) help semen coagulate after ejaculation.

2) Prostate Gland (Single & Surrounds the Urethra)

- 20-25% of the volume of semen.
- Slightly acidic fluid
- (pH 6.5)
- Milky fluid that contains-

- Citric acid –
- Proteolytic enzymes -fibrinolysin
- Seminal plasmin Protein – Antibiotic for bacteria.
- Ca+ and Phosphate. } – ↑ - Motility & Tail

Cowper's Glands/ Bulbourethral Glands

(One pair, size - like peas)

- During sexual arousal, these secrete an alkaline fluid into the urethra that protects the passing sperm by neutralizing acids from urine in the urethra.
- They also secrete mucus that lubricates the end of the penis

Semen = (Sperm + Seminal Plasma) = Seminal Plasma } = Seminal Vesicle + Prostatic + Cowper's } Fluid

- Slightly alkaline (7.2 - 7.7) fluid
- The volume of semen in a typical ejaculation is - 2.5–5 mL, with 200-300 million sperms

Correct sequence of male accessory glands pouring their secretions into urethra : **(AIIMS 2013)**

(1) Prostate, Seminal vesicle, Bulbourethral glands

(2) Seminal vesicle, Prostate, Bulbourethral glands

(3) Bulbourethral glands, Prostate, Seminal vesicle

(4) Prostate, Bulbourethral glands, Seminal vesicle

The testes in humans are situated outside the abdominal cavity inside a pouch called scrotum. The purpose served is for : **(AIPMT Pre 2011)**

(1) Maintaining the scrotal temperature lower than the internal body temperature

(2) Escaping any possible compression by the visceral organs.

(3) Providing more space for the growth of epididymis

(4) Providing a secondary sexual feature for exhibiting the male sex.

If for some reason, the vasa efferentia in the human reproductive system get blocked, the gametes will not be transported from : **(AFMC 2010)**

(1) Testes to epididymis

(2) Epididymis to vas deferens

(3) Ovary to uterus

(4) Vagina to uterus

Sertoli cells are found in : **(AIPMT Pre 2010)**

(1) Pancreas and secrete cholecystokinin

(2) Ovaries and secrete progesterone

(3) Adrenal cortex and secrete adrenaline

(4) Seminiferous tubules and provide nutrition to germ cells

The tunica albuginea is middle connective tissue layer in the wall of the testes which divides testicular space into ___(A)___ compartments called testicular lobules and each lobule contains ___(B)___ highly folded seminiferous tubules in which spermatogenesis occurs.

Choose the option that correctly fills the blanks (A) and (B).

(1) 200 – 250, 5 – 10

(2) 50 – 150, 1 – 3

(3) 300 – 400, 1 – 3

(4) 200 – 250 1 – 3

Trace the **correct** path of movement of the sperms upto urethra.

(1) Seminiferous tubules → Vasa efferentia → Rete testis → Epididymis → Vas deferens → Ejaculatory duct → Urethra

(2) Seminiferous tubules → Rete testis → Epididymis → Vasa efferentia → Vas deferens → Ejaculatory duct → Urethra

(3) Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra

(4) Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Ejaculatory duct → Vas deferens → Urethra

Which of the following is a set of male accessory ducts?

(1) Rete testis, vasa efferentia, tubuli recti

(2) Rete testis, vasa efferentia, epididymis and vas deferens

(3) Epididymis, ejaculatory duct, urethra

(4) Seminiferous tubules, vasa efferentia, epididymis and vas deferens

Which of the following cells can be present in testicular lobules but are located outside seminiferous tubules?

(1) Male germ cells

(2) Interstitial cells

(3) Immunocompetent cells

(4) Both (2) & (3)

THANK YOU !!

MANTHAN NEET

HUMAN REPRODUCTION

LECTURE - 3

ZOOLOGY



MD SIR

TODAY'S GOAL

- ❑ Female reproductive system
- ❑ Vulva
- ❑ Mammary Glands

THE FEMALE REPRODUCTIVE SYSTEM

The Female reproductive system consist of-

1. Ovaries (One pair) → Pri. Sex Organ.
2. Ductus System- Fallopian tube (Oviduct), Uterus (Hystera / Womb), Cervix, Vagina
3. External Genitalia (Vulva) - mons pubis, labia majora, labia minora, hymen and clitoris.
4. Accessory Glands
5. Mammary glands(One Pair) – Sec. sexual character

Uterus / Hystera / Womb

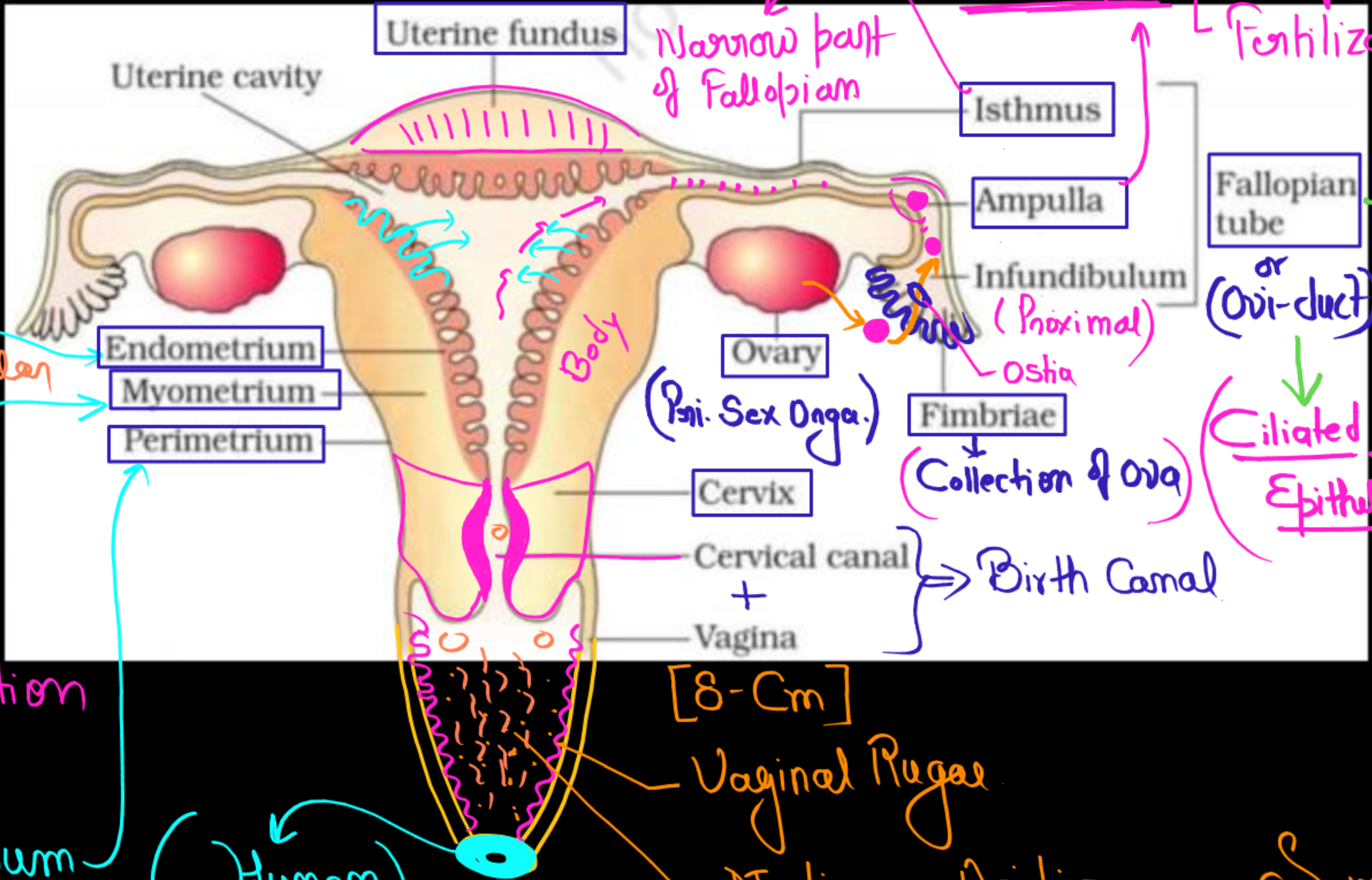
Inverted Pear Shape.

Wall of Uterus →

1) - Inner layer → Endometrium
   - ↳ Secretory / Glandular / Vascular
   - ↳ Show - Cyclic changes during menstrual cycle.

2) - Middle layer → Myometrium
   - ↳ Smooth Muscle
   - ↳ Show Strong Contraction during child Birth.

3) - Outer layer → Perimetrium
   [Formed by Epithelial Tissue.



Narrow part of Fallopian → Isthmus

Widest part [Site of Fertilization] → Ampulla

Fallopian tube (10-12 cm) or (Ovi-duct) → Ciliated Columnar Epithelial Tissue

Infundibulum (Proximal) - Ostia

Ovary (Pri. Sex Orga.)

Fimbriae → (Collection of Ova)

Cervical canal + Vagina → Birth Canal

Vagina [8-Cm]

Vaginal Rugae

Medium = Acidic → through - Symbiotic Bacteria

{Produced Organic acid.

(Hymen) → (Vascular)

Note –

Female Accessory Duct =

1. Oviduct
2. Uterus
3. Vagina

Birth Canal = Cervical canal + vagina

Note –

Female Accessory Duct =

Oviduct

Uterus

Vagina

Birth Canal = Cervical canal + vagina

(1) Ovaries (One Pair)- Primary sex organ

Position –

- The ovaries are located one on each side of the lower abdomen and is connected to the pelvic wall and uterus by ligaments.

Size and shape –

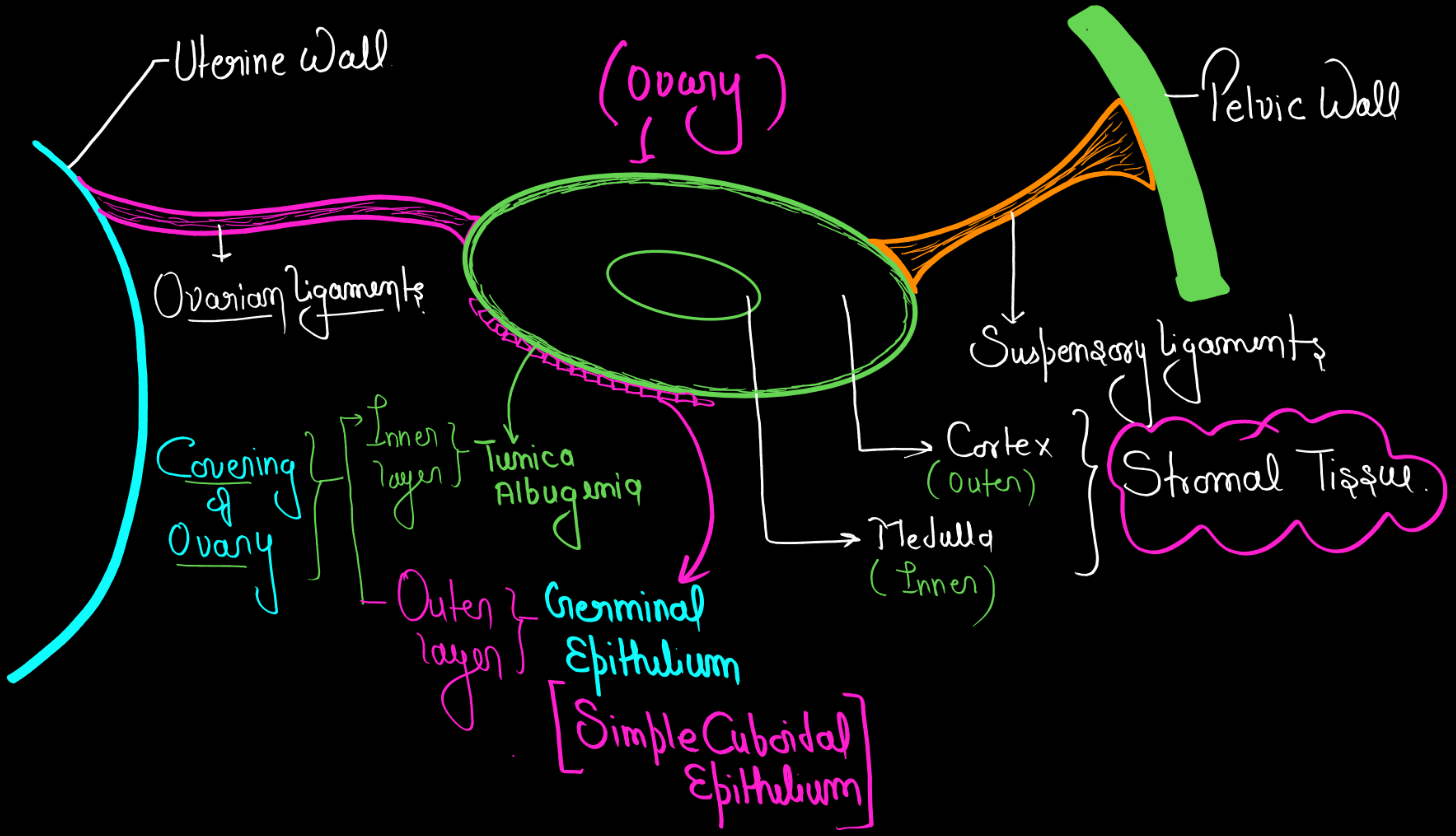
- Length 2-4 cm, almond shape

Origin- Mesodermal

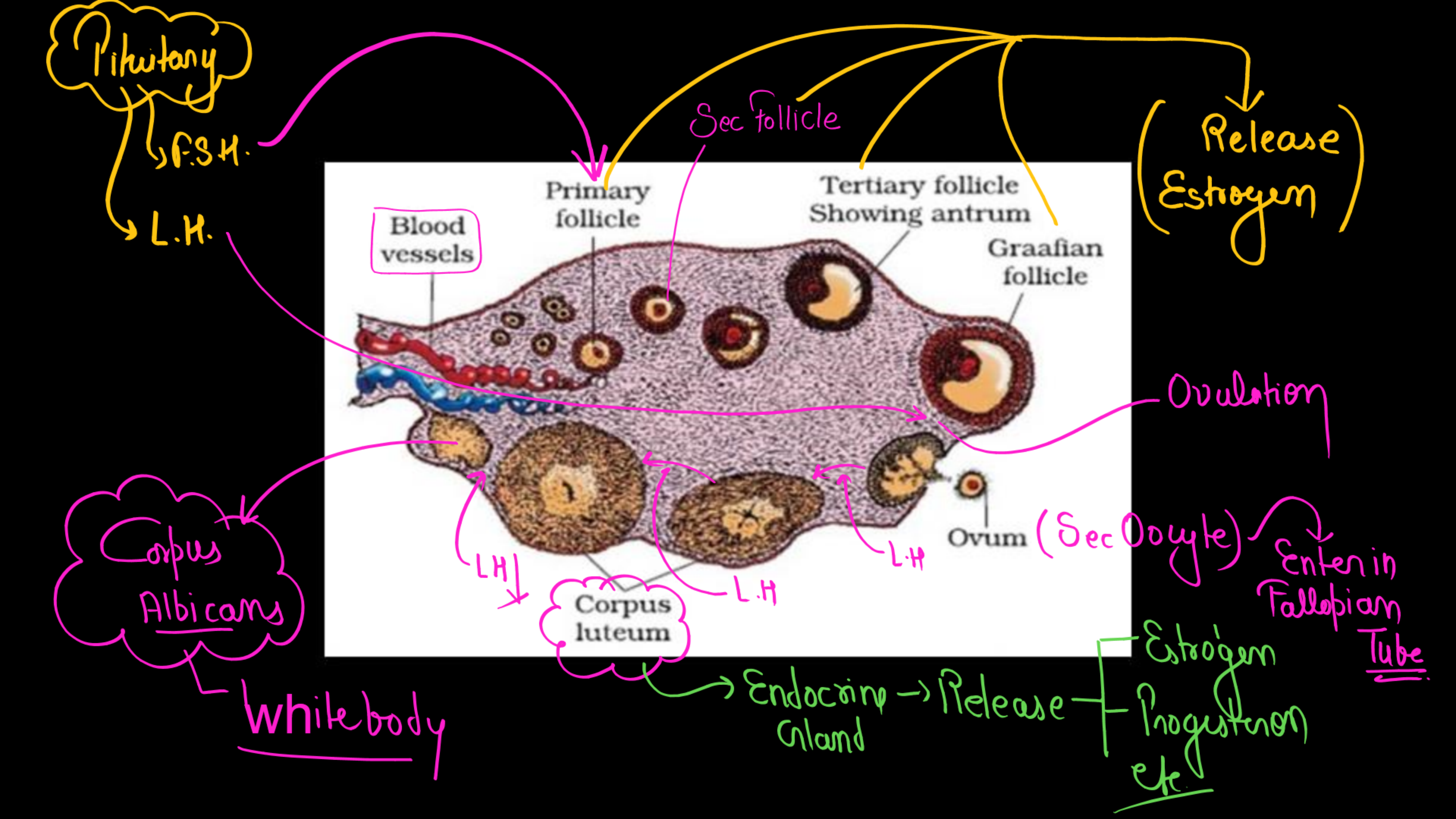
Structure-

Germinal Epithelium

- Each ovary is covered by a thin epithelium which encloses the ovarian stroma. The stroma is divided into two zones – a peripheral cortex and an inner medulla.



Uterine Wall
(Ovary)
Pelvic Wall
Ovarian ligaments
Suspensory ligaments
Covering of Ovary
Inner layer
Tunica Albuginia
Outer layer
Germinal Epithelium
[Simple Cuboidal Epithelium]
Cortex (Outer)
Medulla (Inner)
Stromal Tissue.



Pituitary
F.S.H.
L.H.
Sec follicle
Release Estrogen
Blood vessels
Primary follicle
Tertiary follicle Showing antrum
Graafian follicle
Ovulation
Ovum (Sec Oocyte)
Enter in Fallopian Tube
L.H
L.H
L.H
Corpus luteum
Corpus Albicans
White body
Endocrine Gland → Release
Estrogen
Progesteron
etc

Which of the following is last part of the oviduct, which has narrow lumen and joins with the uterus?

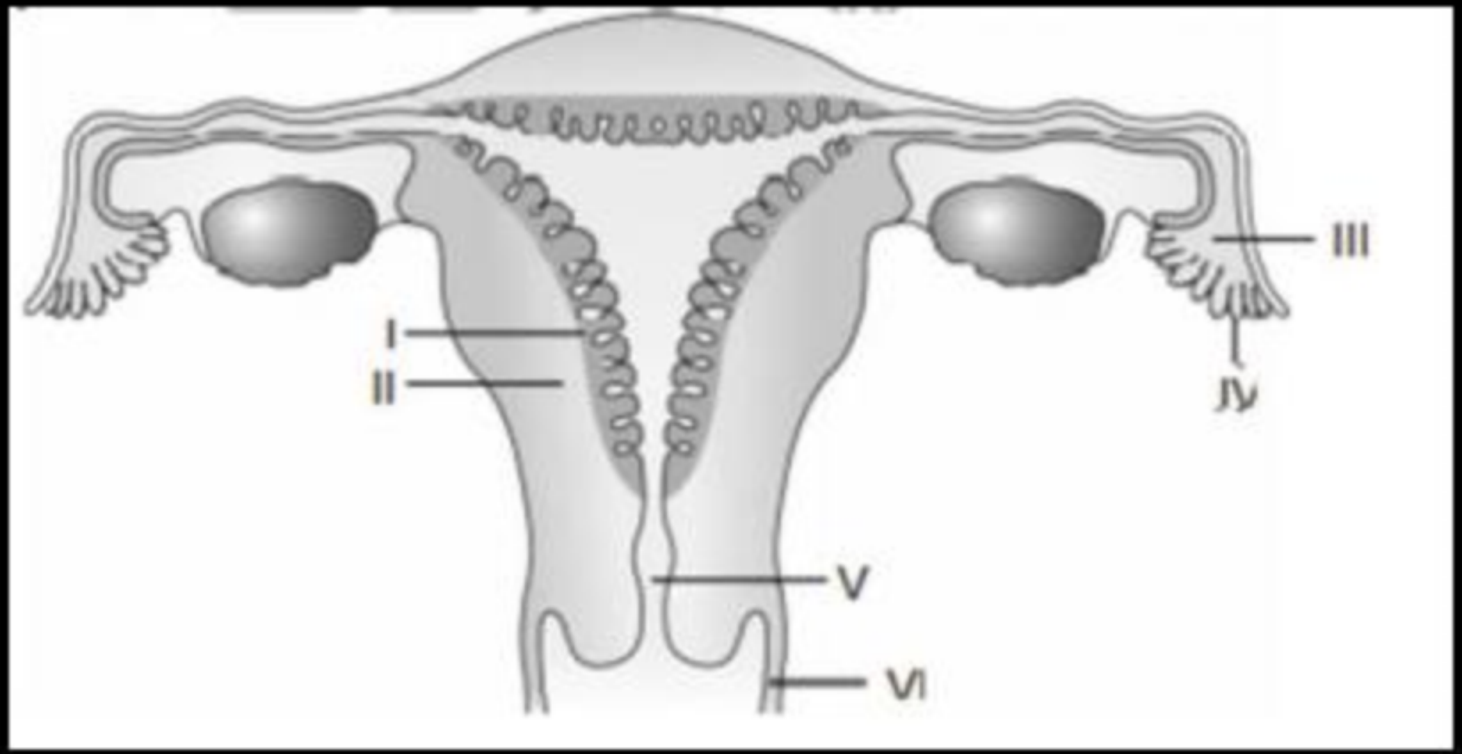
(1) Ampulla
(2) Isthmus
(3) Infundibulum
(4) Fimbriae

Hysterectomy is surgical removal of **[AIPMT-2015]**

(1) Mammary glands
(2) Uterus
(3) Prostate gland
(4) Vas-deference

Which of the following depicts the site of impantation of blastocyst under normal condition

(1) II (2) V
(3) I (4) VI



Which of the following organs is devoid of glands?

(1) Uterus
(2) Vagina
(3) Vulva
(4) Oviduct

. Which of the following is a **correct** match?

(1) Endometrium – External thin membranous layer of uterus

(2) Myometrium – Exhibits strong uterine contractions during the delivery of baby

(3) Uterus – Birth canal

(4) Cervical canal and vagina – Womb

The female external genitalia includes :

(a) Mons pubis

(b) Labia majora

(c) Labia minora

(d) Hymen

(e) Clitoris

(f) Vagina

Options :

(1) a, b and c

(2) d, e and f

(3) a, b, c and f

(4) a, b, c, d and e

Number of mammary lobes in each breast is :

(1) 5 - 10

(2) 15 - 20

(3) 20 - 30

(4) 1 - 2

The female reproductive system along with a pair of the mammary glands are integrated structurally and functionally to support

(1) Ovulation and fertilization

(2) Pregnancy and birth

(3) Birth and child care

(4) All of these

THANK YOU !!

MANTHAN NEET

HUMAN REPRODUCTION

LECTURE - 4

ZOOLOGY



MD SIR

TODAY'S GOAL

- ❑ Vulva – External genitalia.
- ❑ Mammary Glands
- ❑ Lactation
- ❑ Spermatogenasis

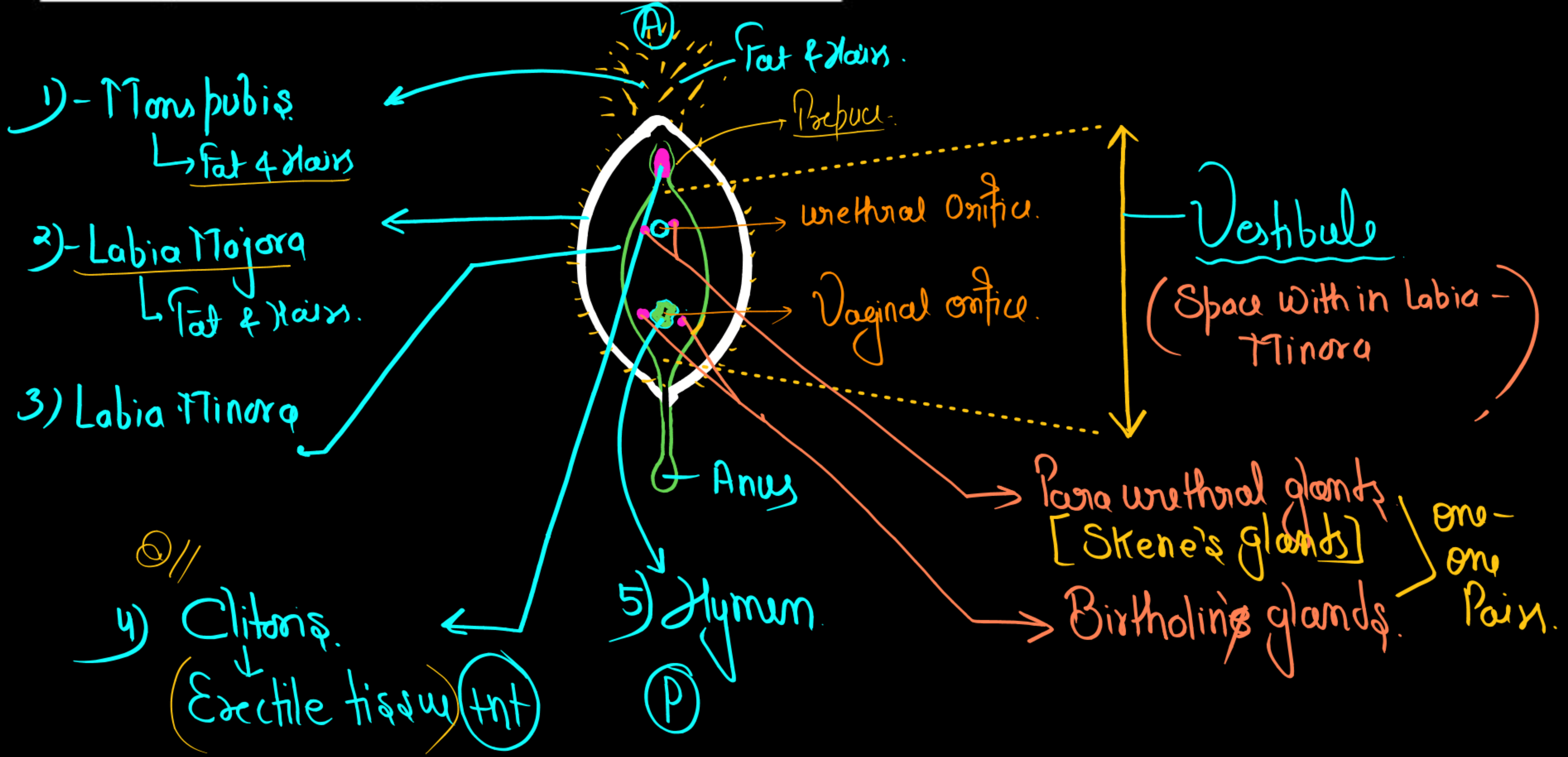
Vulva/Pudendum/ External genitalia (+nt in Pelvic Region)

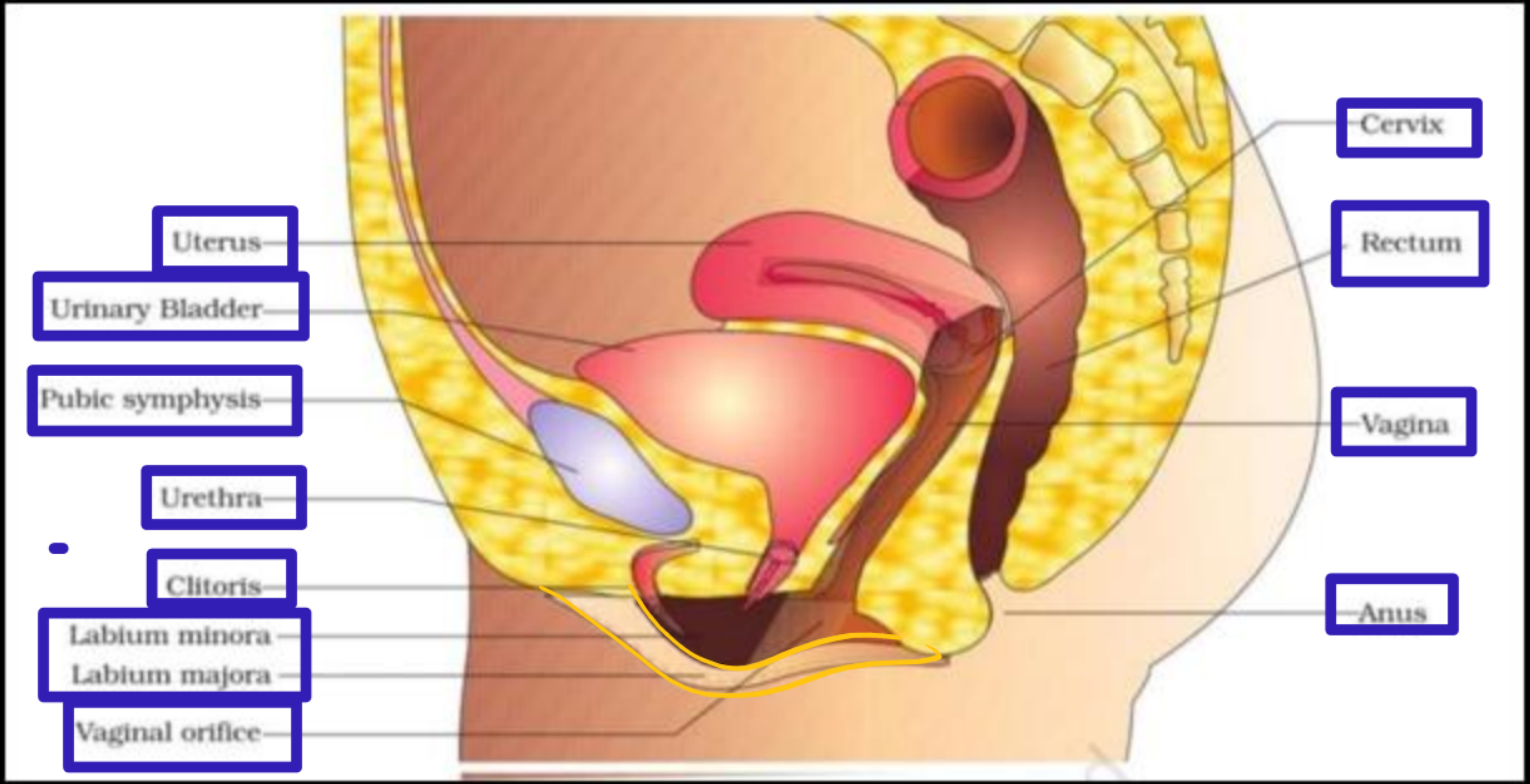
a. Mons pubis
b. Labia majora
c. Labia minora
d. Clitoris - (homologous to glans penis in males)
e. Hymen (if still present)
f. Vestibule -

Within the vestibule are the-

- Vaginal orifice
- External urethral orifice
- Openings of the ducts of vestibular glands

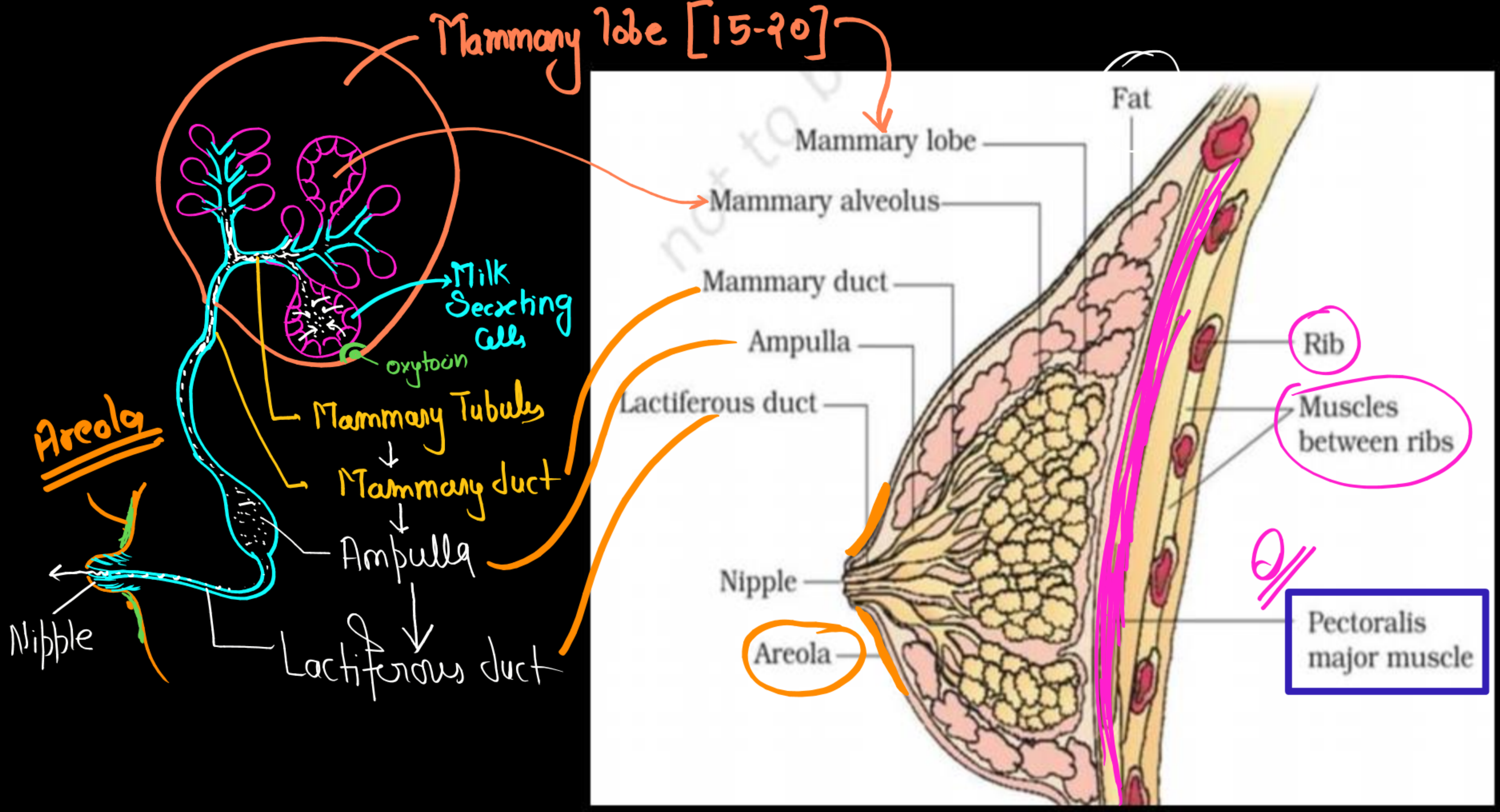
Vulva/Pudendum/ External genitalia

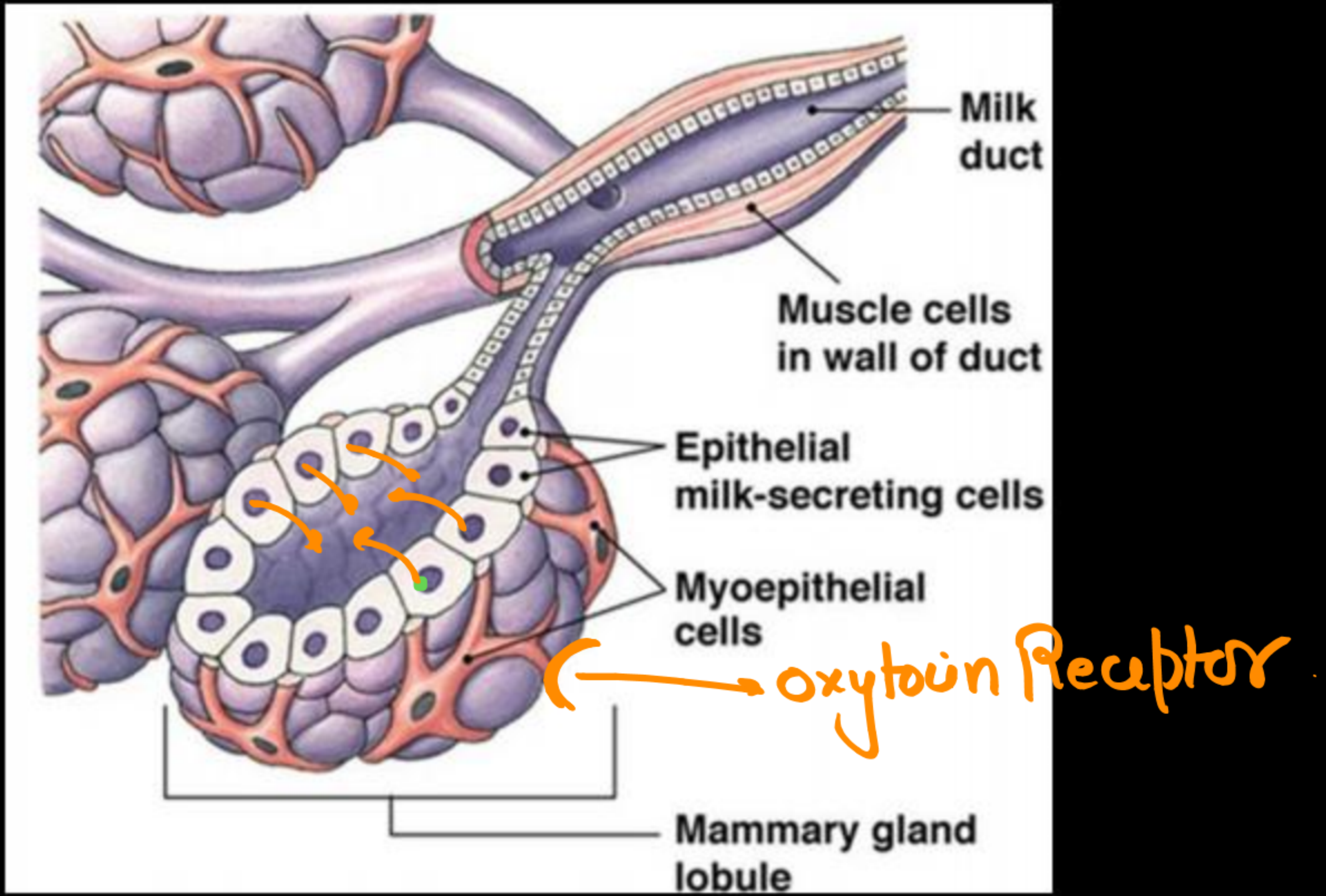



Uterus
Urinary Bladder
Pubic symphysis
Urethra
Clitoris
Labium minora
Labium majora
Vaginal orifice
Cervix
Rectum
Vagina
Anus

Mammary Glands-

- Mammary glands is a modified apocrine sweat (sudoriferous) gland that produces milk.
- Mammary glands attach with pactoralis major muscles through cooper's ligaments.
- A mammary gland consists of 15 to 20 lobes.
- In each lobe are several smaller compartments called lobules, composed of grape like clusters of milk-secreting glands termed alveoli (small cavities).
- Each lactiferous duct typically carries milk from one of the lobes to the exterior


Mammary lobe [15-20]
Milk Secreting cells
oxytocin
Mammary Tubules
Mammary duct
Ampulla
Lactiferous duct
Areola
Nipple
Mammary lobe
Mammary alveolus
Mammary duct
Ampulla
Lactiferous duct
Nipple
Areola
Fat
Rib
Muscles between ribs
Pectoralis major muscle

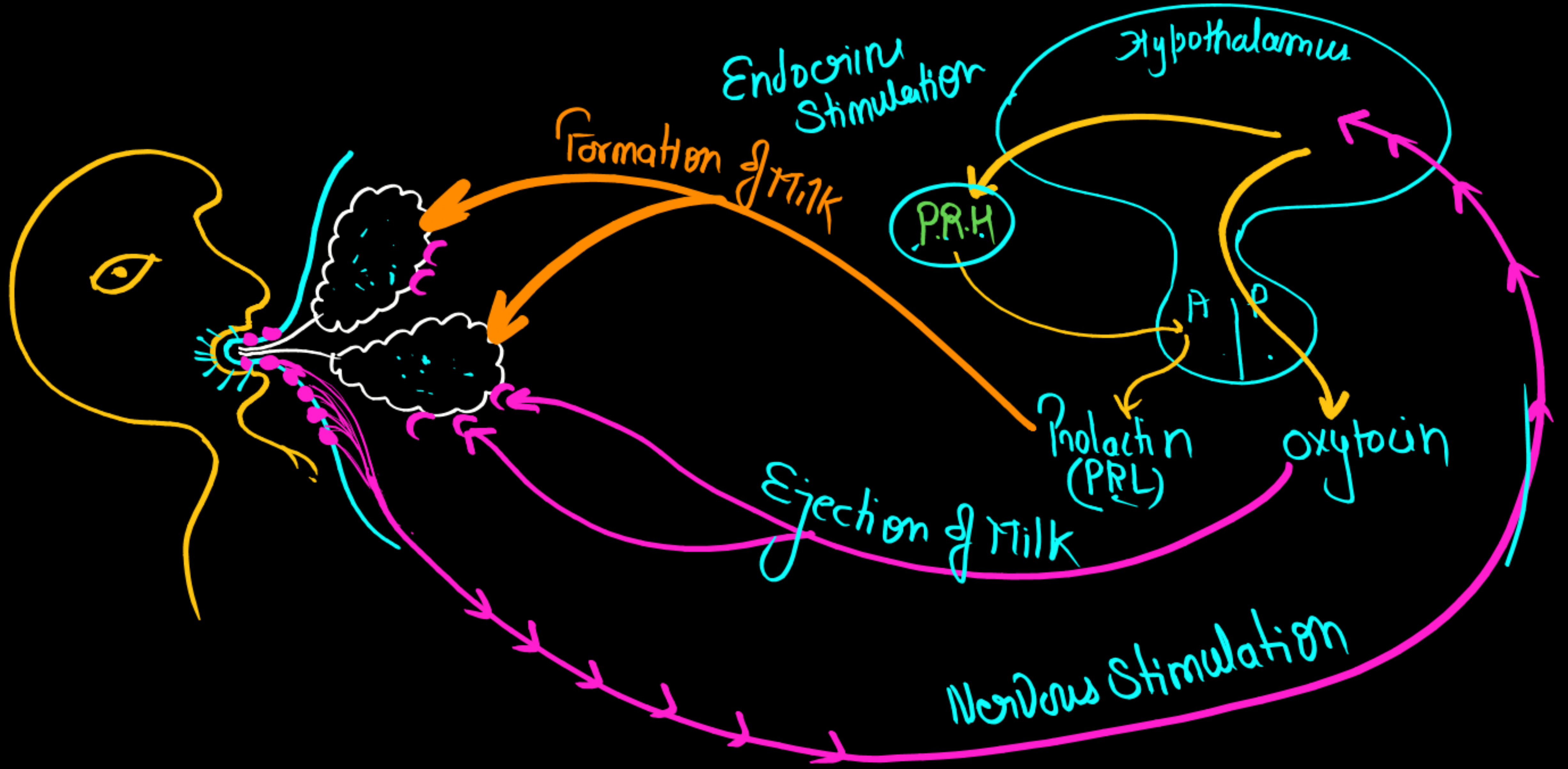

Milk duct
Muscle cells in wall of duct
Epithelial milk-secreting cells
Myoepithelial cells
Mammary gland lobule
oxytocin Receptor

Lactation-

- Growth of mammary glands during puberty is called thelarche, which regulate by- Estrogen and during pregnancy regulate by Progesterone and Lactogenic hormone (PRL & hPL).
- Even though prolactin levels increase as the pregnancy progresses, no milk secretion occurs because progesterone inhibits the effects of prolactin. After delivery, the levels of estrogens and progesterone in the mother's blood decrease, and the inhibition is removed.

- Milk secretion/formation hormone = Prolactin (A. pituitary)
- Milk ejaction hormone = Oxytocin (P. pituitary)

The principal stimulus in maintaining prolactin secretion during lactation is the sucking action of the infant. → Neuro-Endocrine Mechanism



Spermatogenesis –

It begins during puberty and continues till death. In humans, this process takes 65-75 days.

Spermatogenesis

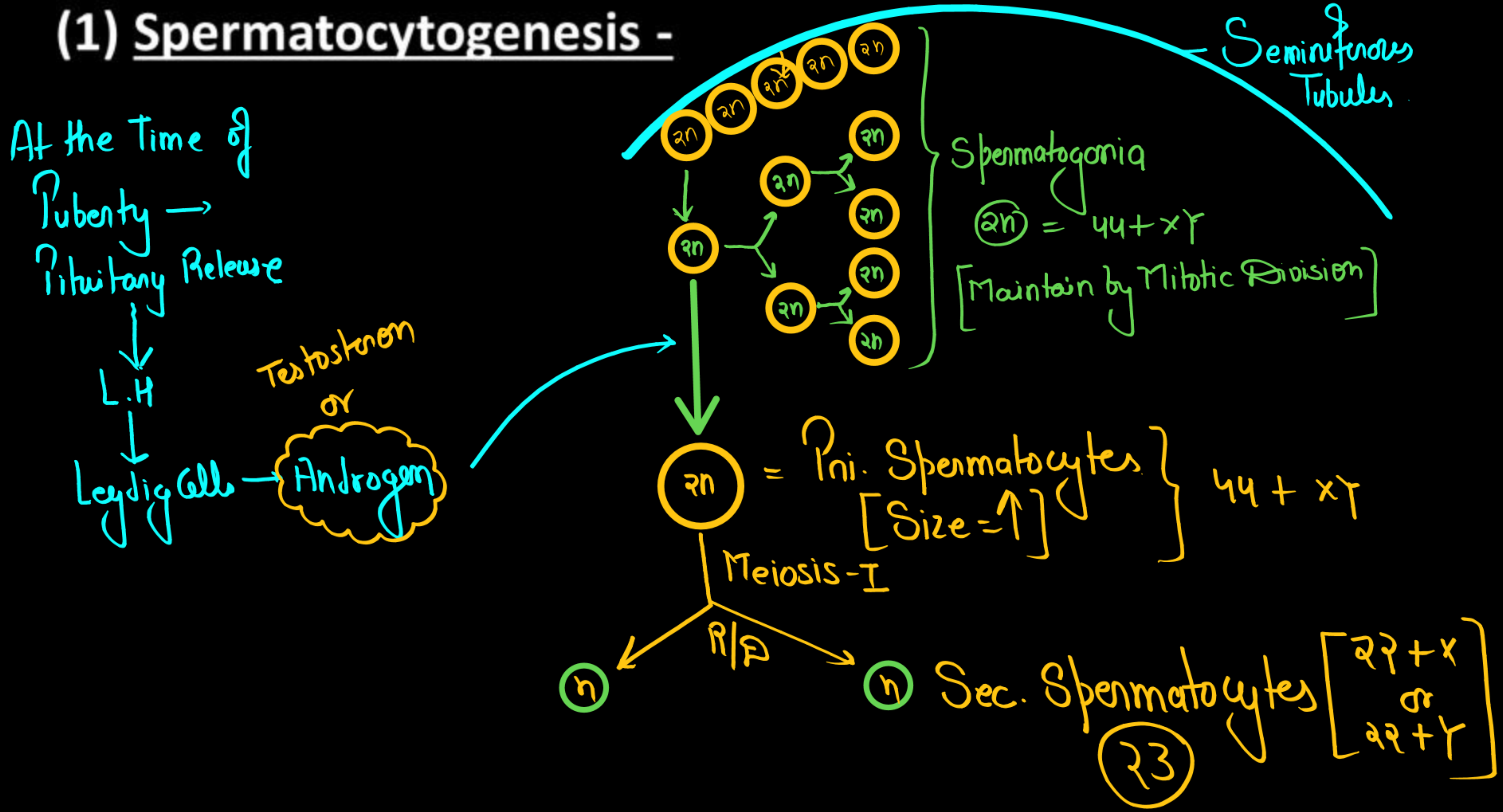
(1) Spermatocytogenesis –

It is formation of spermatids from spermatogonia.

(2) Spermiogenesis/Spermateliosis

(Longest phase) -It is differentiation of spermatids (metamorphosis) into sperms.

(1) Spermatocytogenesis -



Pituitary
↓
F.S.H
↓
Sertoli cells
↳ Sperm Maturation Factor → Spermiogenesis

n = Sec. Spermatocytes

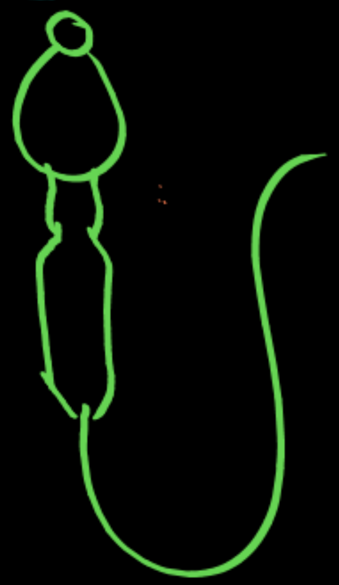
Meiosis-II

E/P

n n Spermatids (4)

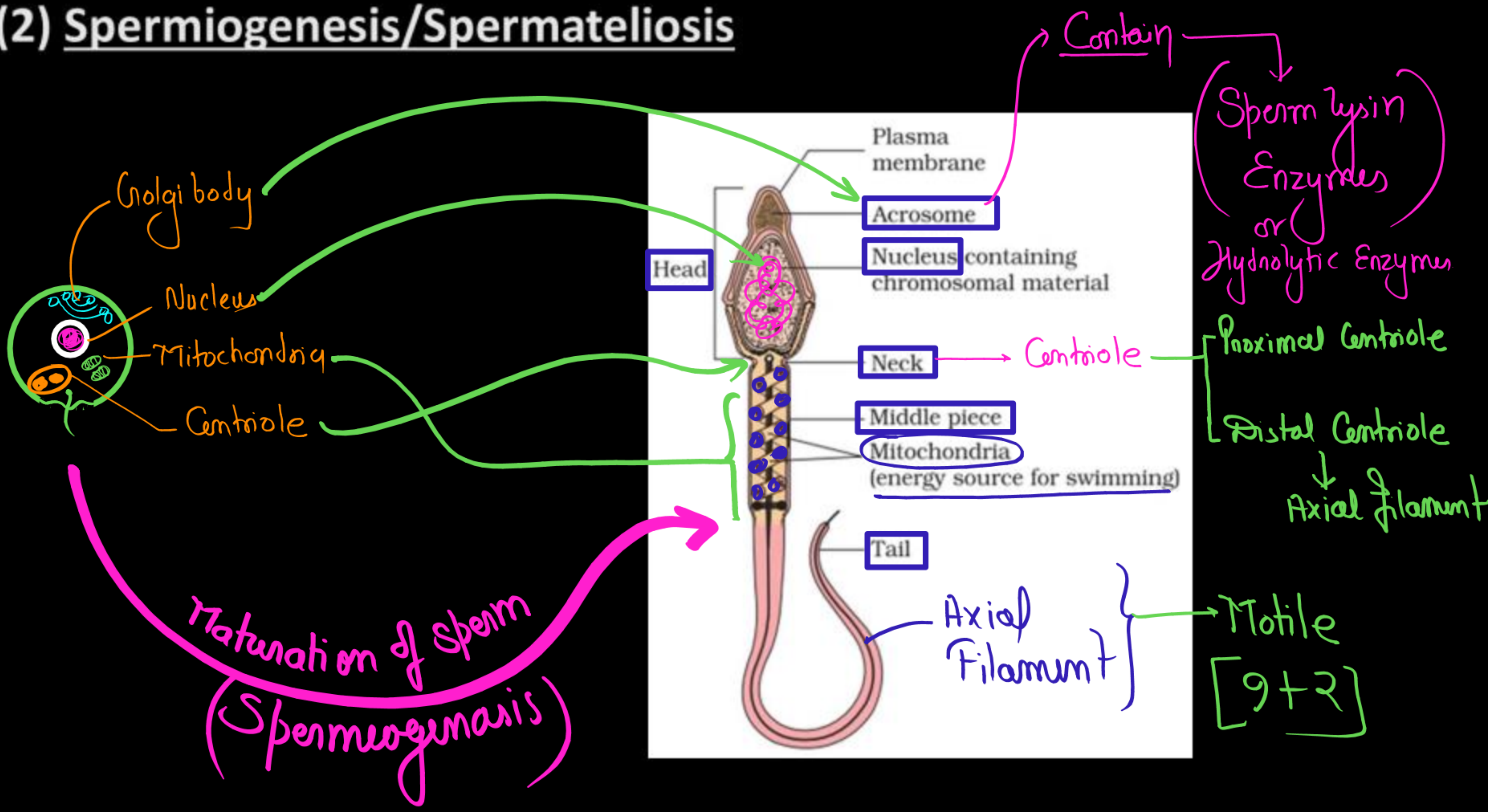
} Spermatocytogenesis.

Spermiogenesis [Maturation of Sperm (Longest phase)]

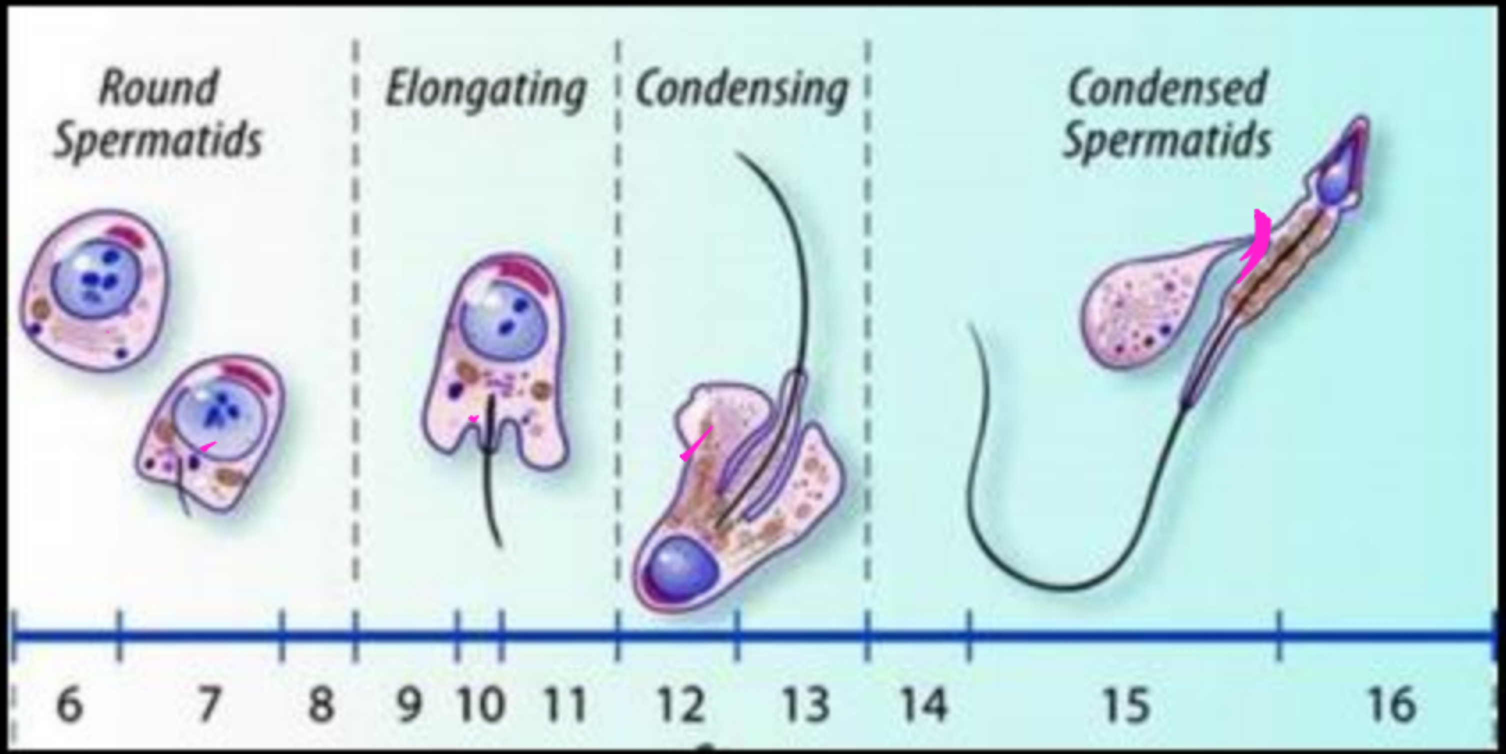


(4) Sperm (Spermatozoa)

(2) Spermiogenesis/Spermateliosis



- After spermiogenesis, sperm heads become embedded in the Sertoli cells, and are finally released from the seminiferous tubules by the process called spermiation.



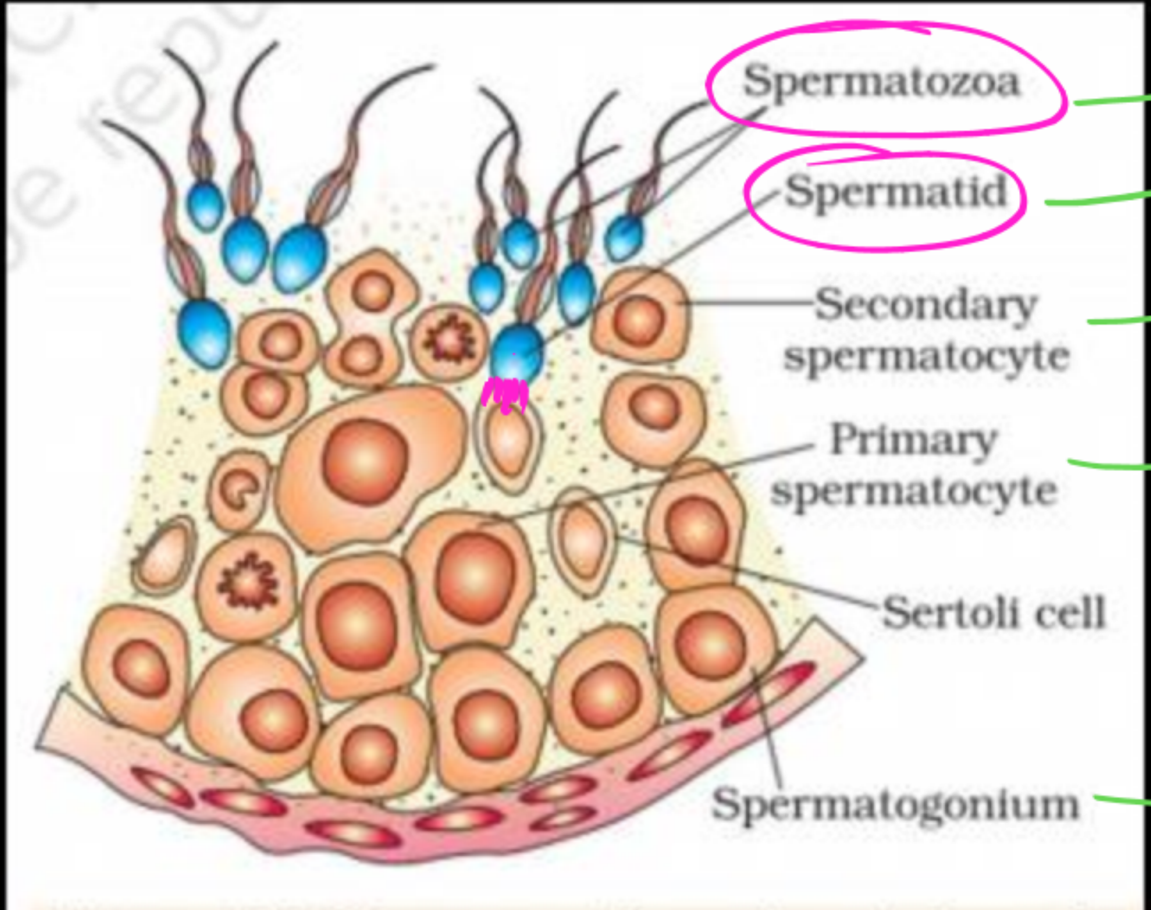


Figure 3.5 Diagrammatic sectional view of a seminiferous tubule (enlarged)

For formation of 100 sperms

- How many meiotic division are required = 25
- How many Pri. spermatocytes are required = 25
- How many Sec. spermatocytes are required= 50
- How many spermatids are required = 100

Note

The human male ejaculates about 200 to 300 million sperms during a coitus of which, for normal fertility, at least 60 per cent sperms must have normal shape and size and at least 40 per cent of them must show vigorous motility.

The female external genitalia includes :

(a) Mons pubis

(b) Labia majora

(c) Labia minora

(d) Hymen

(e) Clitoris

(f) Vagina

Options :

(1) a, b and c

(2) d, e and f

(3) a, b, c and f

(4) a, b, c, d and e

Number of mammary lobes in each breast is :

(1) 5 - 10

(2) 15 - 20

(3) 20 - 30

(4) 1 - 2

The female reproductive system along with a pair of the mammary glands are integrated structurally and functionally to support

(1) Ovulation and fertilization

(2) Pregnancy and birth

(3) Birth and child care

(4) All of these

The number of spermatozoa produced by a secondary spermatocyte is

(1) One

(2) Two

(3) Eight

(4) Four

In spermatogenesis, the acrosome of sperm is formed by

(1) Golgi complex
(2) Mitochondria
(3) Lysosome
(4) Nucleus

THANK YOU !!

MANTHAN NEET

HUMAN REPRODUCTION

LECTURE - 5

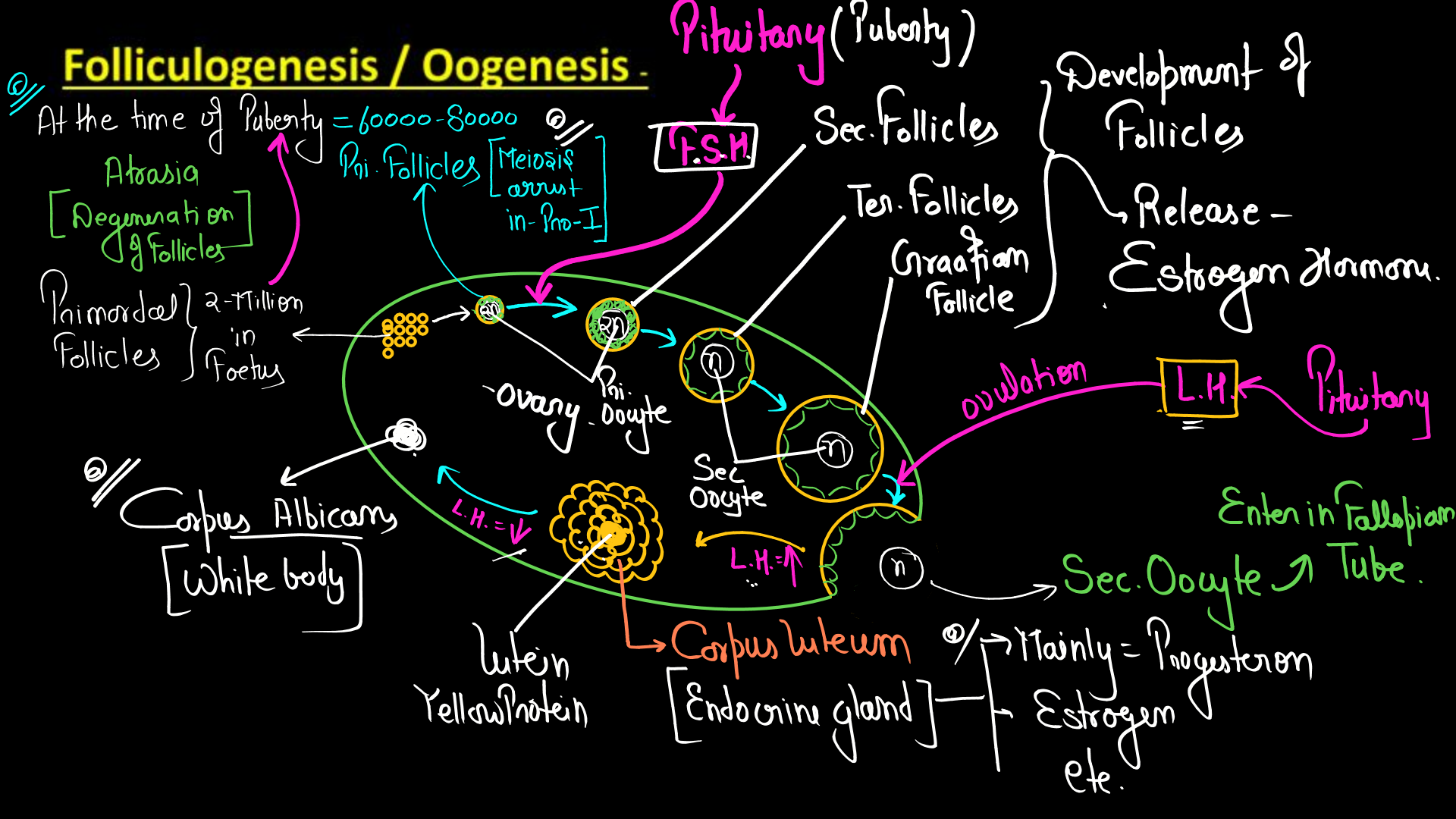
ZOOLOGY



MD SIR

TODAY'S GOAL

- ❑ Oogenesis



Folliculogenesis / Oogenesis
Q//
At the time of Puberty = 60000-80000
Atrasia
[Degeneration of Follicles]
Primordial Follicles
2-Million in Foetus
Q//
Pri. Follicles [Meiosis arrest in Pro-I]
Pituitary (Puberty)
F.S.H.
Sec. Follicles
Ter. Follicles
Graafian Follicle
Development of Follicles
Release
Estrogen Hormone.
Ovary
Pri. Oocyte
Sec Oocyte
ovulation
L.H.
Pituitary
Enter in Fallopian Tube.
Sec. Oocyte
L.H. = ↓
L.H. = ↑
Q//
Corpus Albicans
[White body]
Lutein
Yellow Protein
Corpus luteum
[Endocrine gland]
Q/ Mainly = Progesteron
Estrogen
etc.

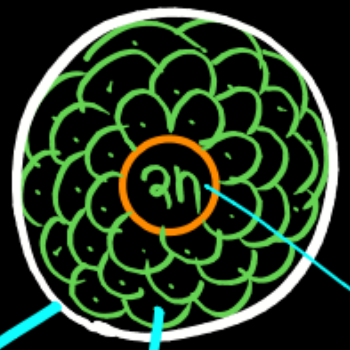
Pri. Follicle →



- Pri. Oocyte
  - ↓ [Meiosis arrest in Prophase-I]
- Single layer of granulosa Cells

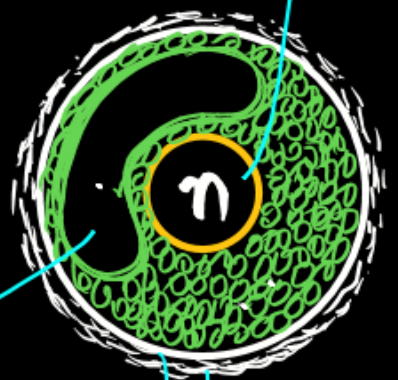
Sec. Follicle

- → Multilayer of Granulosa
- → Formation of Theca
- → In Pri. Oocyte Arrest Meiosis – Start



- Theca
- Multilayer of Granulosa Cells
- Pri. Oocyte ↓ Meiosis become-Start

Ter. Follicle → (Sec. Oocyte)



Oocyte → [Meiosis - I - Complete]

2n → n Sec Oocyte

→ n

unequal division of Cytoplasm

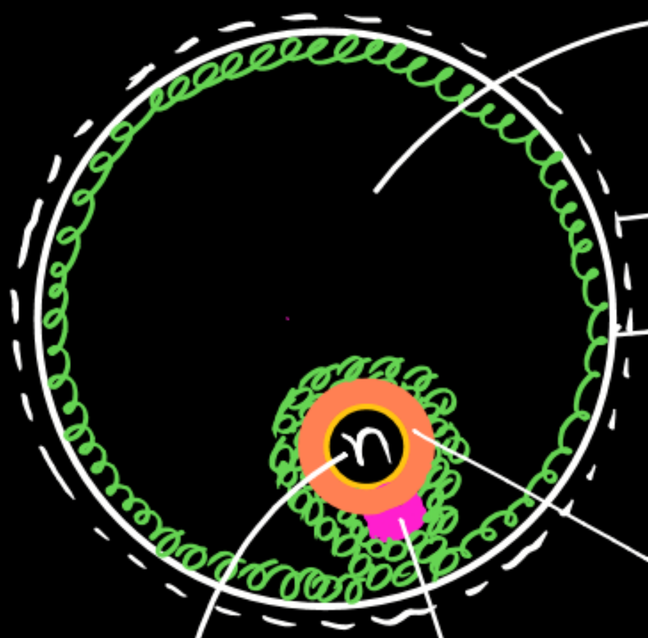
→ Formation of Ist Polar body

- Theca Externa
- Theca Interna

→ (Estrogen)

Antrum [Fluid filled Cavity]

Graafian Follicle



Size of Antrum = ↑

- Ex.
- Interna

Q/ Zona pellucida [Non cellular]

Cumulus Ophorus

Q

Q // Sec Oocyte = Meiosis Again

arrest in = Metaphase - II

Graafian Follicle

↓ ovulation by L.H.

→ Sec Oocyte enter in Fallopian For fertilization

↓ L.H. = ↑

Corpus luteum → Progesteron, Estrogen etc.

↓ L.H. ↓

(Corpus Albicans)

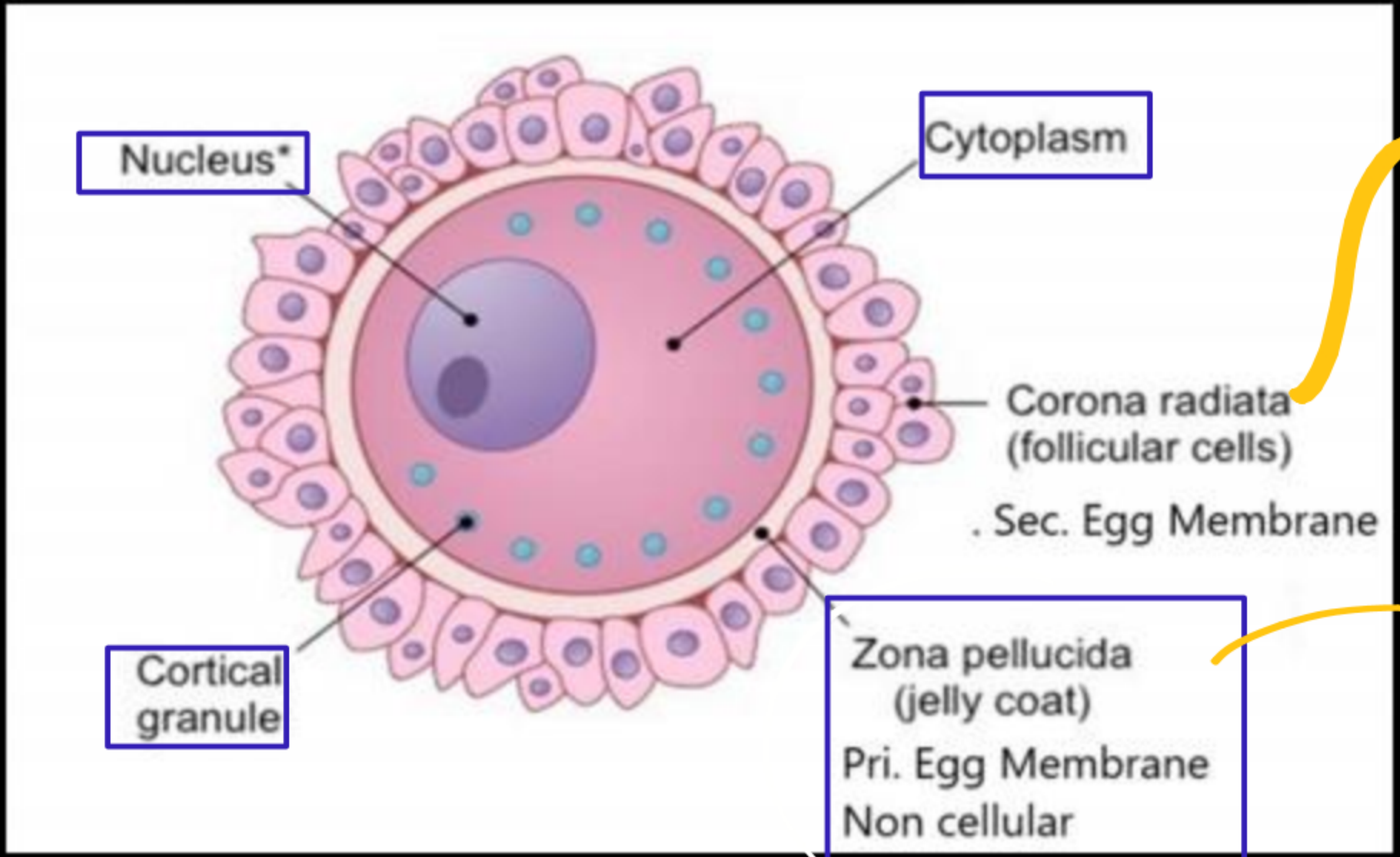
Note –

- Pri. Oocyte
  - Pri. Follicle
  - Sec. Follicle
- Sec. Oocyte
  - Ter. Follicle
  - Graafian Follicle.

Human Egg/ Ovum / Sec Oocyte /

Types of egg- Alecithal (Yolk –nt)

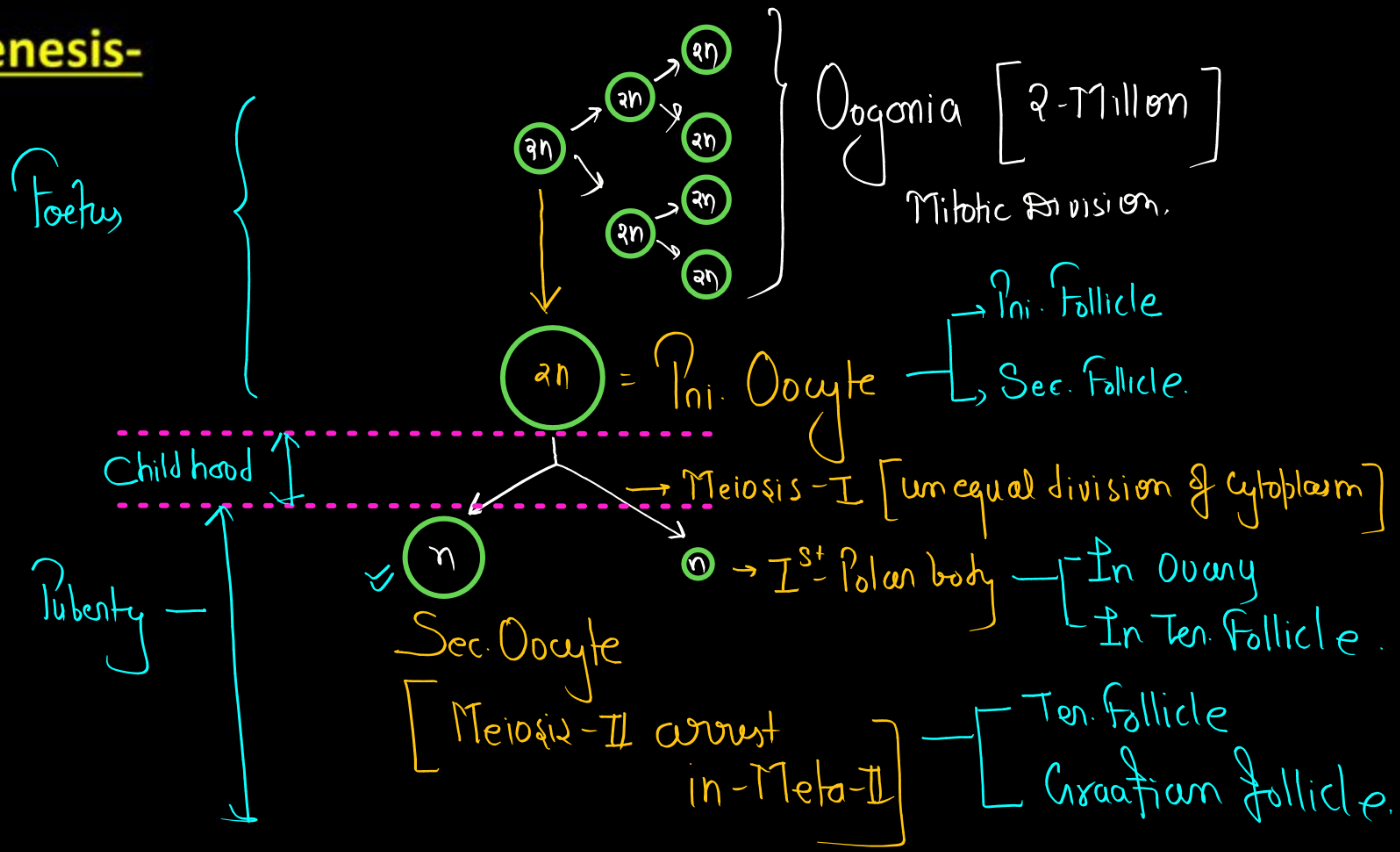
Size- 0.1 mm

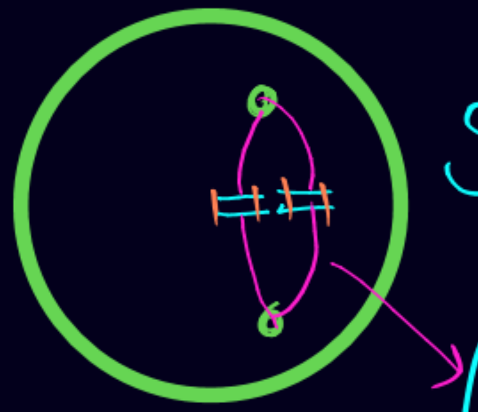


Sec. Egg Mem.
↓
Form by Modification of Granulosa Cells.

Release by Egg.

Oogenesis-


Foetus
2n
Oogonia [2-Million]
Mitotic Division.
2n = Pri. Oocyte
Pri. Follicle
Sec. Follicle.
Childhood
Meiosis-I [unequal division of cytoplasm]
n
Sec. Oocyte
n → I^st Polar body
In Ovary
In Ter. Follicle.
Puberty
[Meiosis-II arrest in-Meta-II]
Ter. follicle
Graafian follicle.



Sec Oocyte = After Ovulation enter in Fallopian Tube

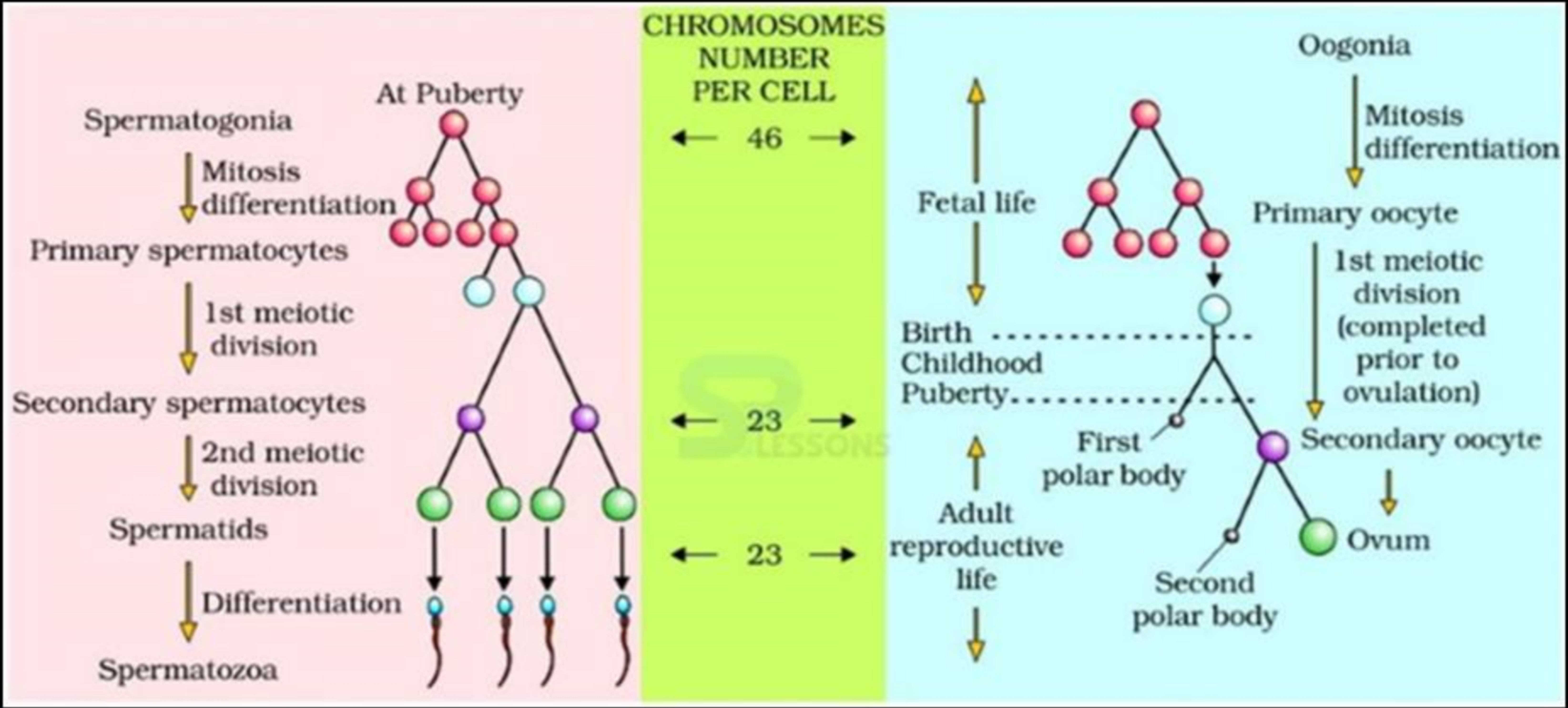
(Meiosis arrest in Meta-II)



IInd Polar body = Form After enter of Sperm and before Completion of Fertilization [In Fallopian Tube]

⇓

[Zygote] (2n)



CHROMOSOMES NUMBER PER CELL
At Puberty
Spermatogonia
Mitosis differentiation
Primary spermatocytes
1st meiotic division
Secondary spermatocytes
2nd meiotic division
Spermatids
Differentiation
Spermatozoa
46
23
23
Fetal life
Birth
Childhood
Puberty
Adult reproductive life
Oogonia
Mitosis differentiation
Primary oocyte
1st meiotic division (completed prior to ovulation)
Secondary oocyte
First polar body
Ovum
Second polar body

THANK YOU !!

MANTHAN NEET

HUMAN REPRODUCTION

LECTURE - 6

ZOOLOGY

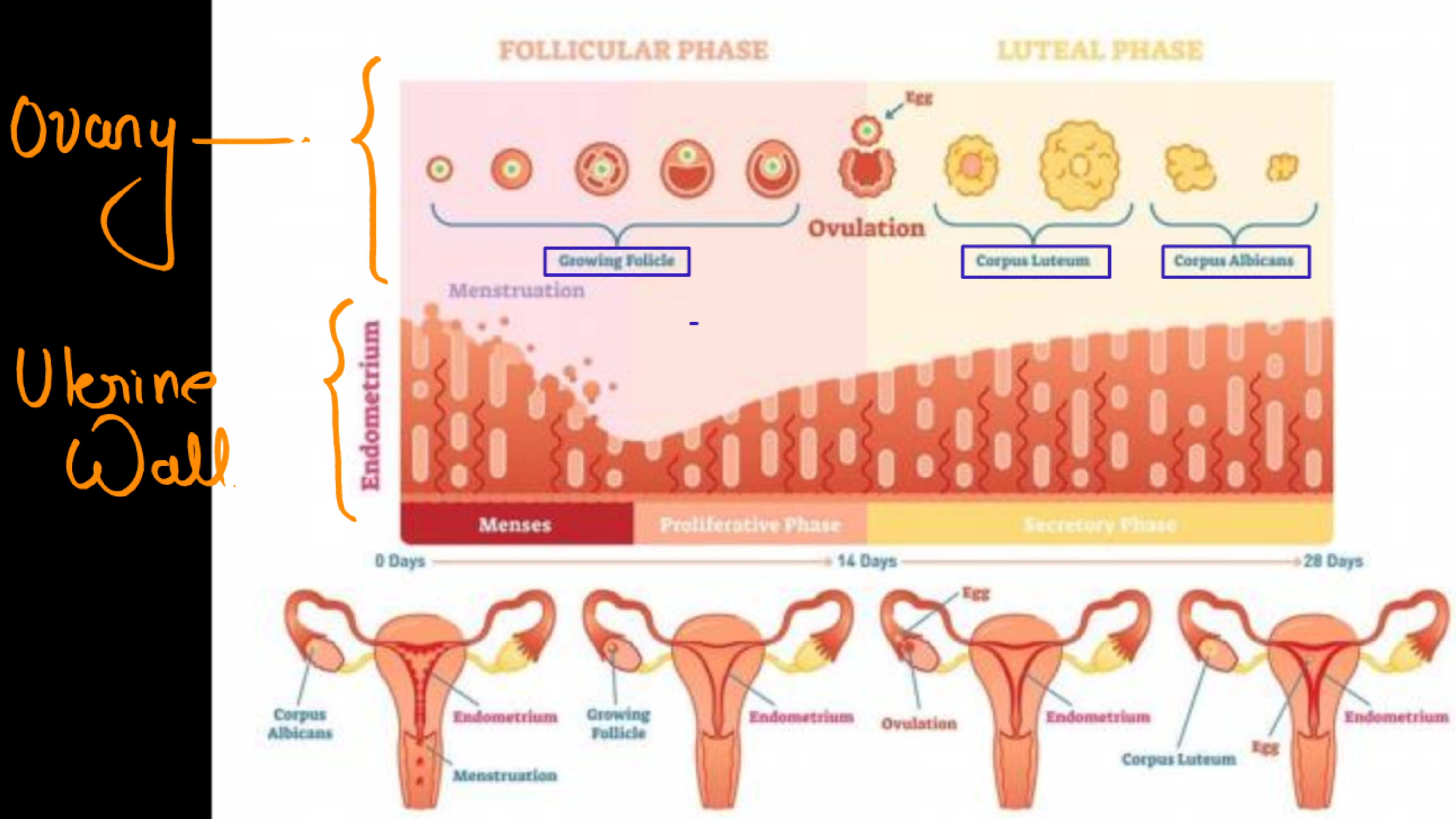


MD SIR

TODAY'S GOAL

- ❑ MENSTRUAL CYCLE

FEMALE SEXUAL CYCLE



MENSTRUAL CYCLE

The reproductive cycle in the female primates (e.g. monkeys, apes and human beings) is called menstrual cycle. The first menstruation begins at puberty and is called menarche.

The duration of the female reproductive cycle typically ranges from 24 to 35 days (28 +/- 2 days), which divide into following phases:

(1) On the basis of Ovarian cycle

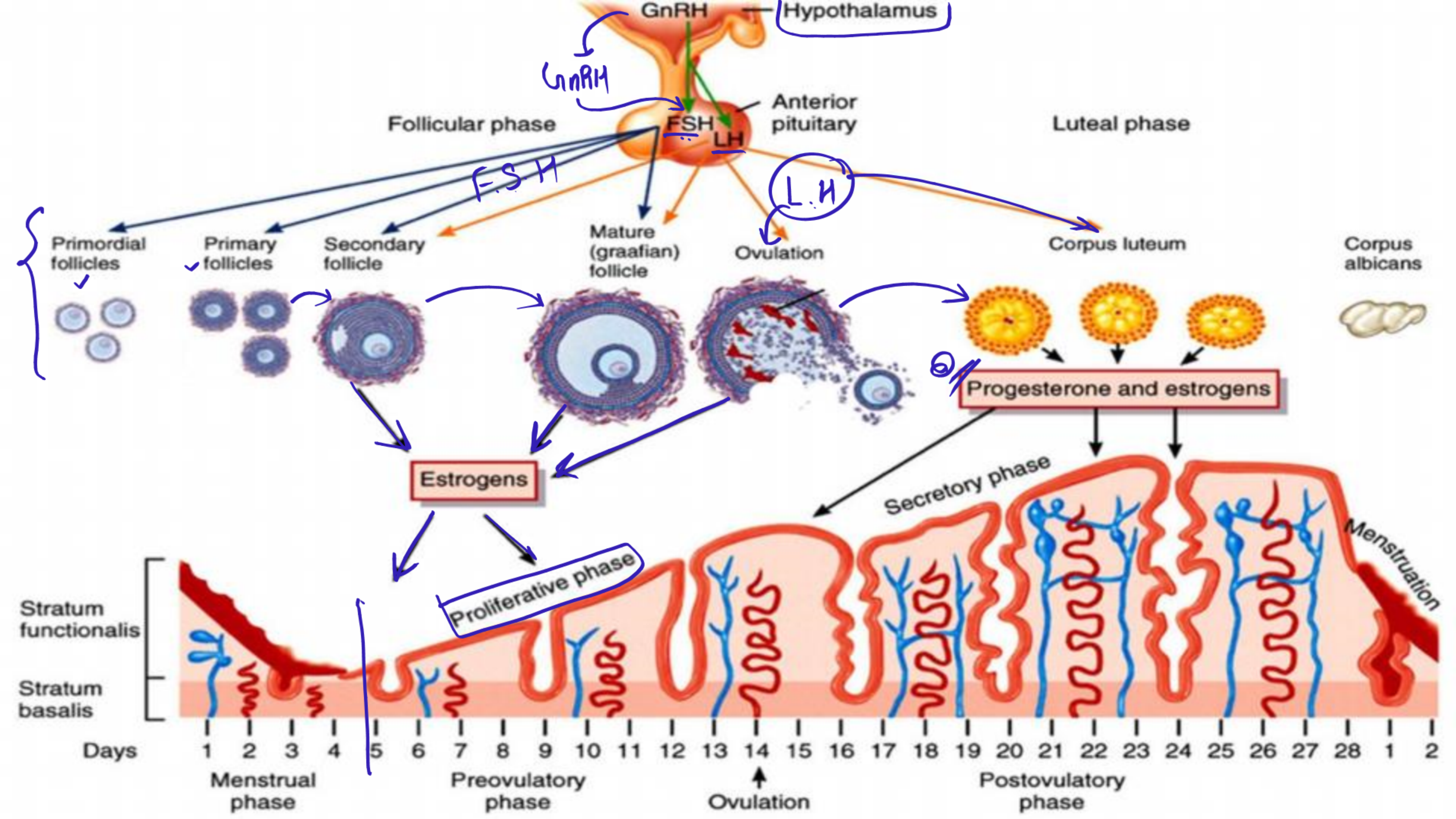
(series of events in the ovaries)

- Follicular Phase [6-13 days] - Development of Follicle
- Ovulation [14th Day = Ovulation]
- Luteal Phase [Last 14th days]

(2) On the basis of Uterine (menstrual) cycle

(series of changes in the endometrium)

- Menstrual phase [1-5 day] = Breakdown of Endometrium
- Proliferative phase [6-13] = Formation of Endometrium
- Secretory phase [14-28] =



GnRH
Hypothalamus
Anterior pituitary
Follicular phase
FSH
LH
Luteal phase
Primordial follicles
Primary follicles
Secondary follicle
Mature (graafian) follicle
Ovulation
Corpus luteum
Corpus albicans
Progesterone and estrogens
Estrogens
Secretory phase
Proliferative phase
Menstruation
Stratum functionalis
Stratum basalis
Days
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 1 2
Menstrual phase
Preovulatory phase
Ovulation
Postovulatory phase

MENTSTRUAL PHASE [1-5 days]

1) - Breakdown of Endometrium

→ ↓ level of Progesteron & Estrogen

→ Maintain Endometrium.

↓

Degeneration of Corpus luteum

→ ↓ level of L.H [Release from A. Pituitary]

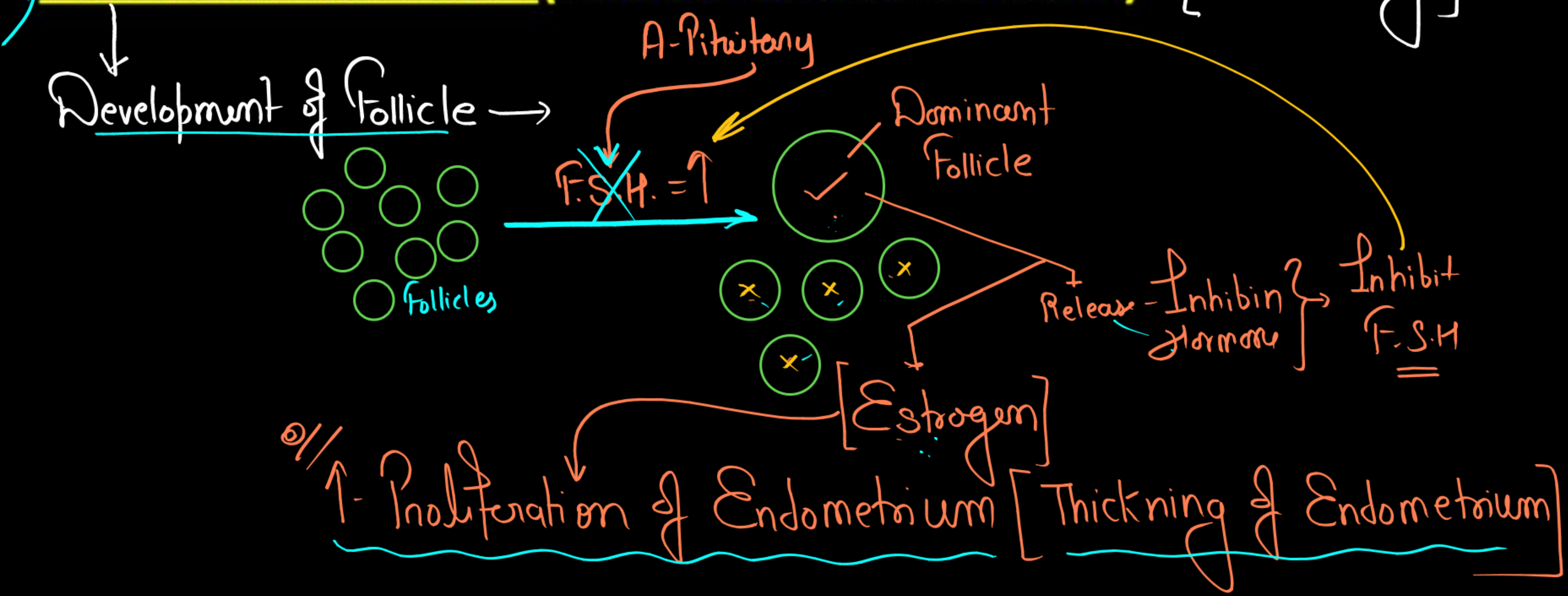
↓

↑ - Secretion of Prostaglandin (Local Hormone)

[Contraction in Smooth Muscles of Uterine Wall]

Blood loss. [50-150 ml]

2) FOLLICULAR PHASE (PROLIFERATIVE PHASE) = [6 – 13 days]



OVULATION (14th day)

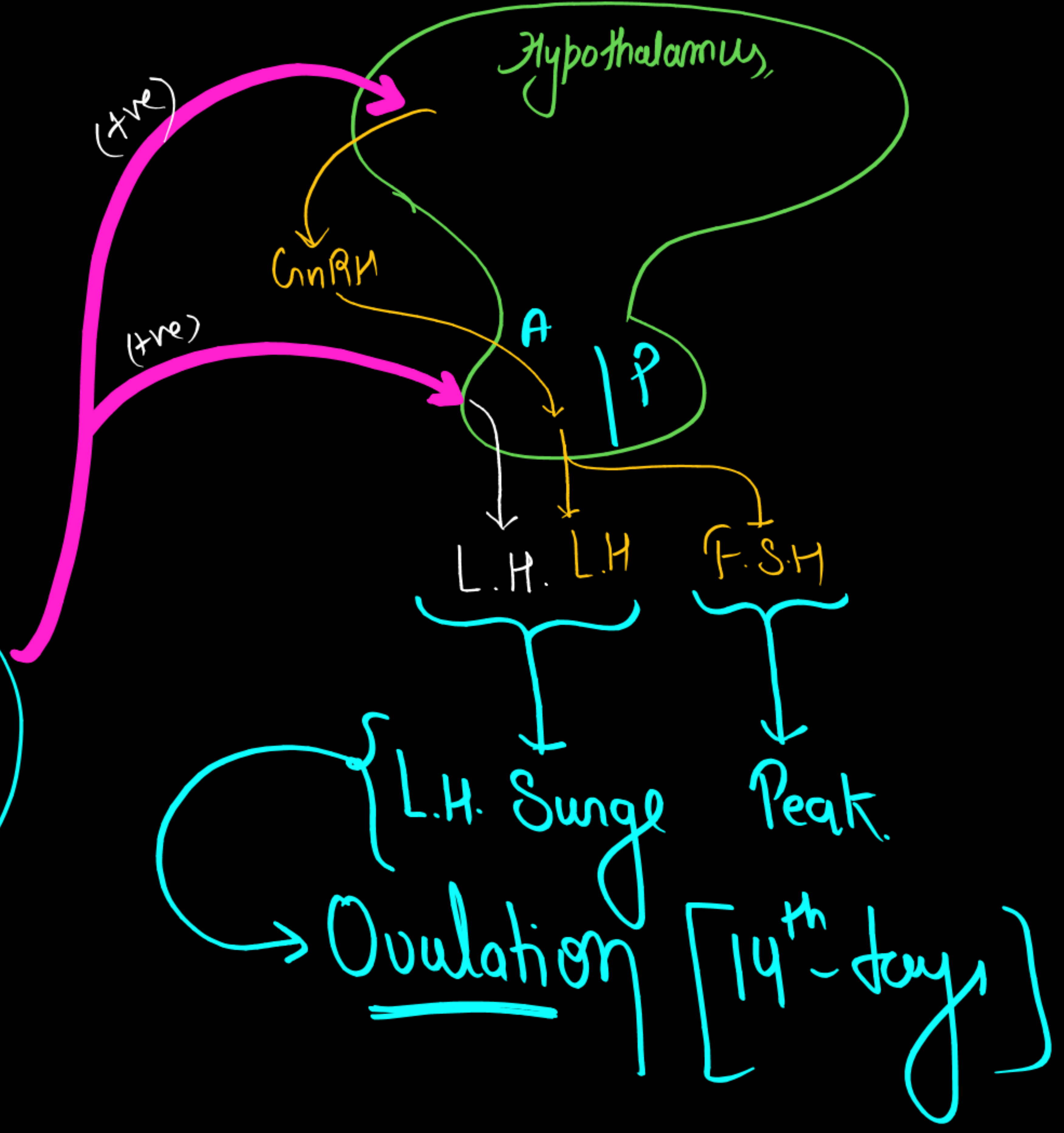
At the end of Follicular Phase

(Size of Follicle = ↑)

↓

(↑ - Level of Estrogen at Peak)

13th - day



Day of Ovulation = Total days of M.C. − 14

=

Total Days of M.C. = 30 = ?

= 18 = ?

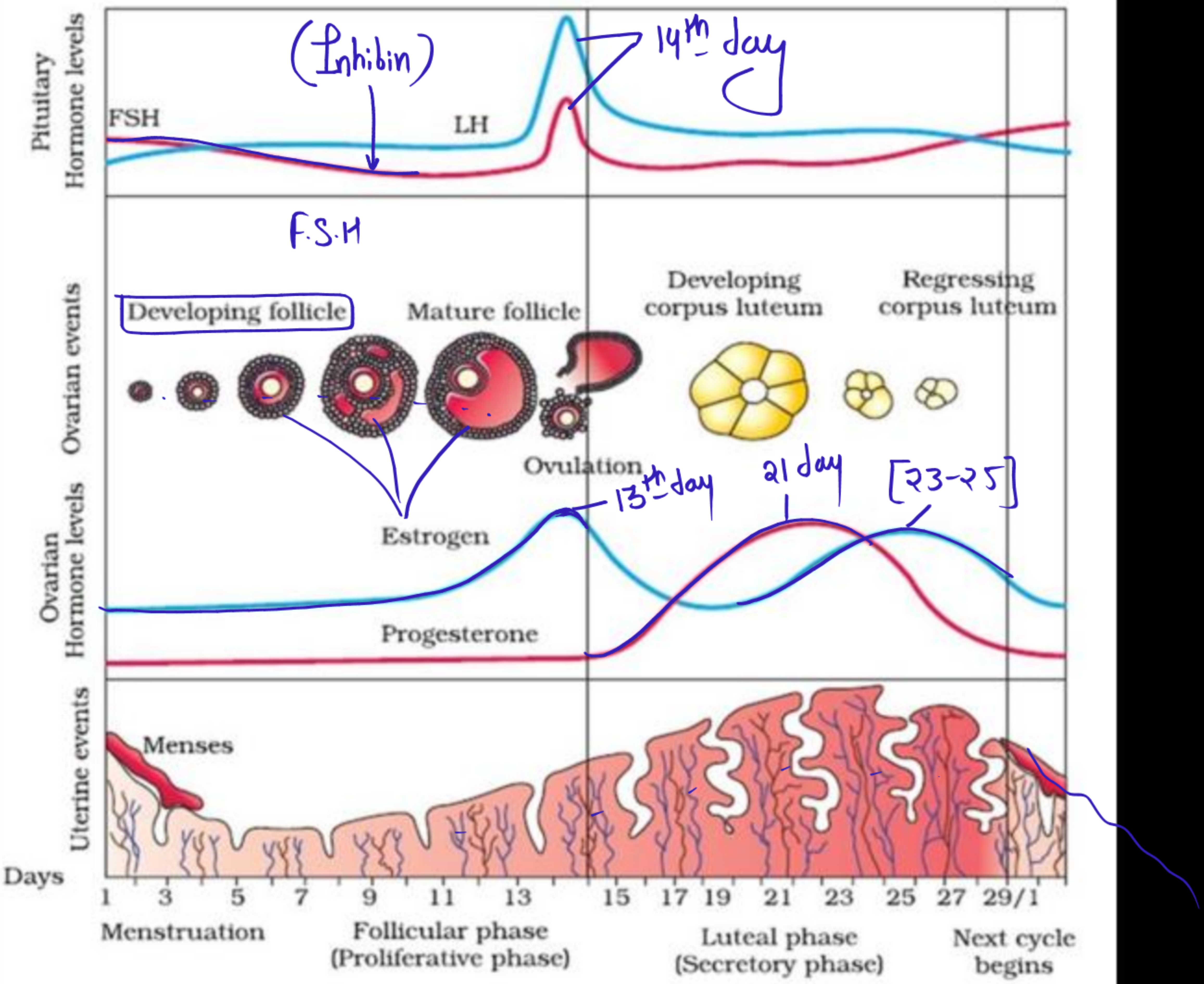
= 23 = ?

LUTEAL PHASE (SECRETORY PHASE)

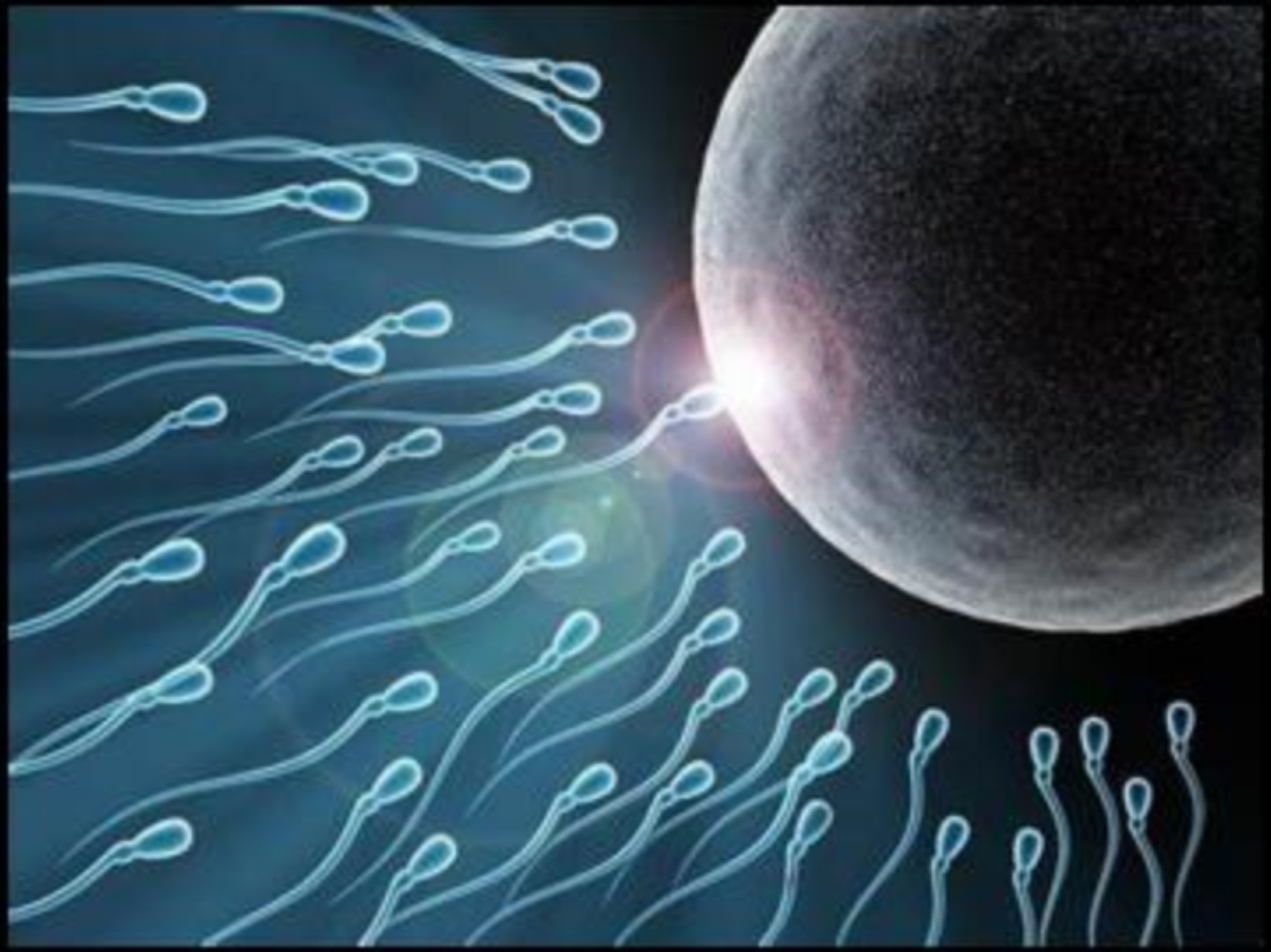
↳ Formation of Corpus luteum (by - L.H.)

Act as Endocrine gland

- Mainly Progesteron
  - Responsible for thermogenic Effect [↑-Temp.]
  - Maintain Endometrium
  - Endometrium become = Secretory — Release Uterine Milk.
    - = Glandular
    - = Highly Vascular
- Estrogen
  - [Further thickning of Endometrium]
- Inhibin etc.
  - Inhibit - F.S.H



Pituitary Hormone levels
FSH
LH
(Inhibin)
14th day
F.S.H
Ovarian events
Developing follicle
Mature follicle
Developing corpus luteum
Regressing corpus luteum
Ovulation
13th day
21 day
[23-25]
Ovarian Hormone levels
Estrogen
Progesterone
Uterine events
Menses
Days
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29/1
Menstruation
Follicular phase (Proliferative phase)
Luteal phase (Secretory phase)
Next cycle begins



Fertilisation

THANK YOU !!

MANTHAN NEET

HUMAN REPRODUCTION

LECTURE - 7

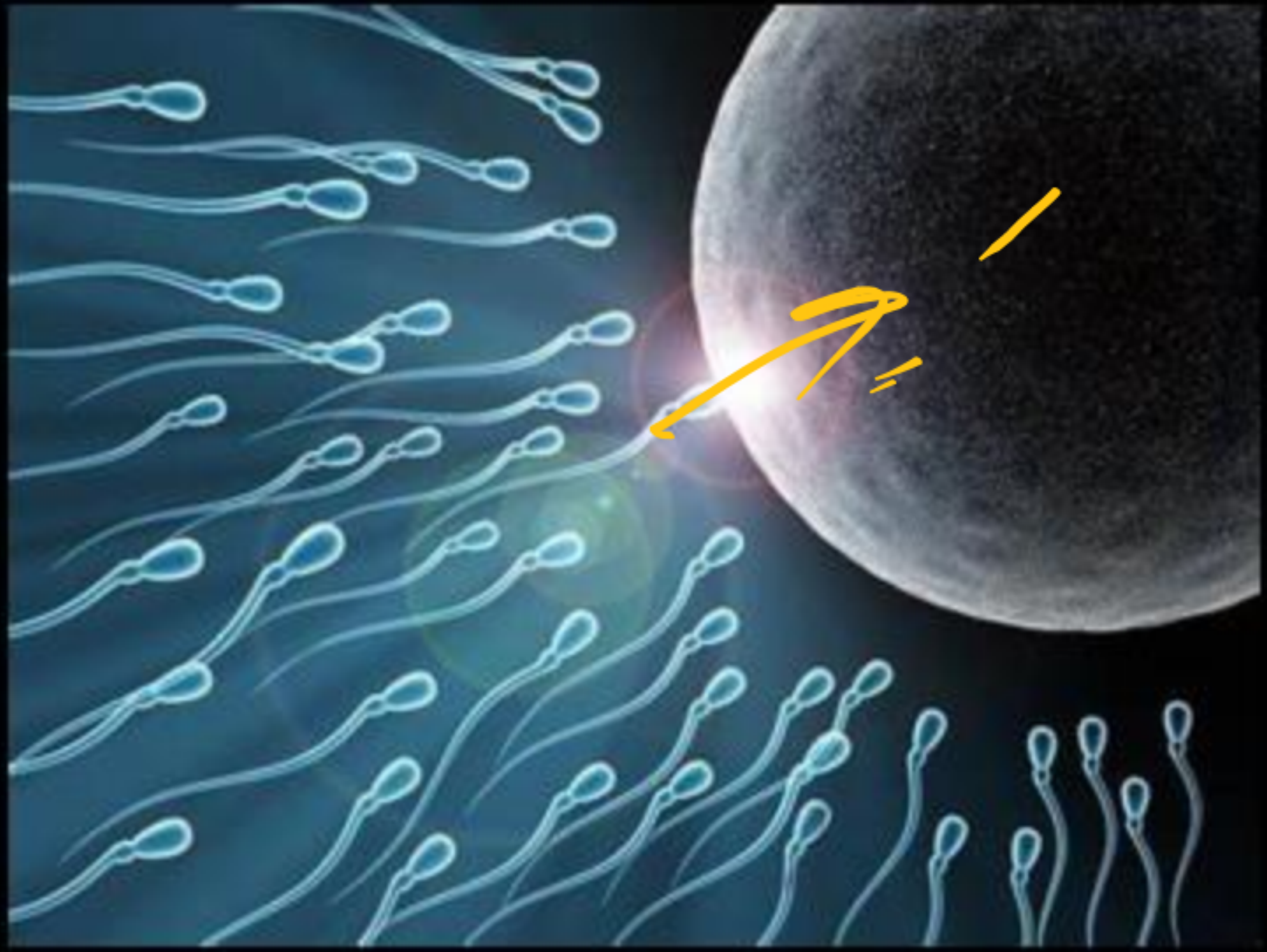
ZOOLOGY



MD SIR

TODAY'S GOAL

- ❑ Fertilization ✓
- ❑ Implantation ✓



Fertilisation

Zygote

Amphimixis

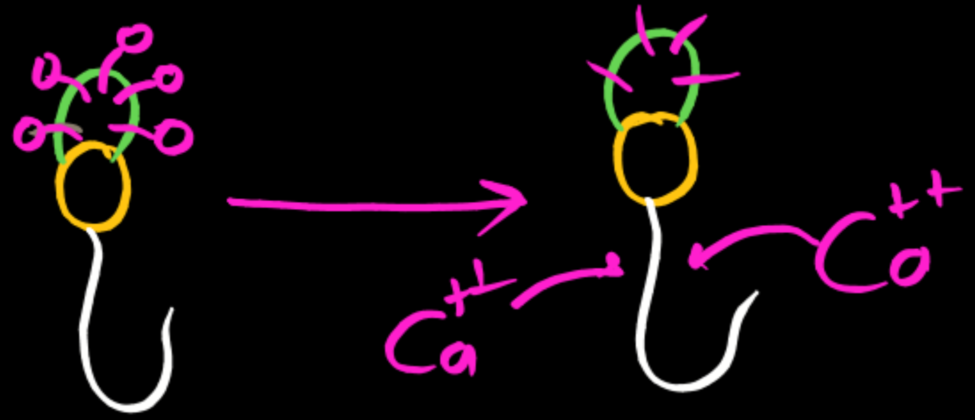
Karyogamy

Syngamy – Plasmogamy

ova

What is Fertilisation –

It involves the fusion of two haploid gametes, each containing 23 chromosomes, producing a zygote that contains 46 chromosomes



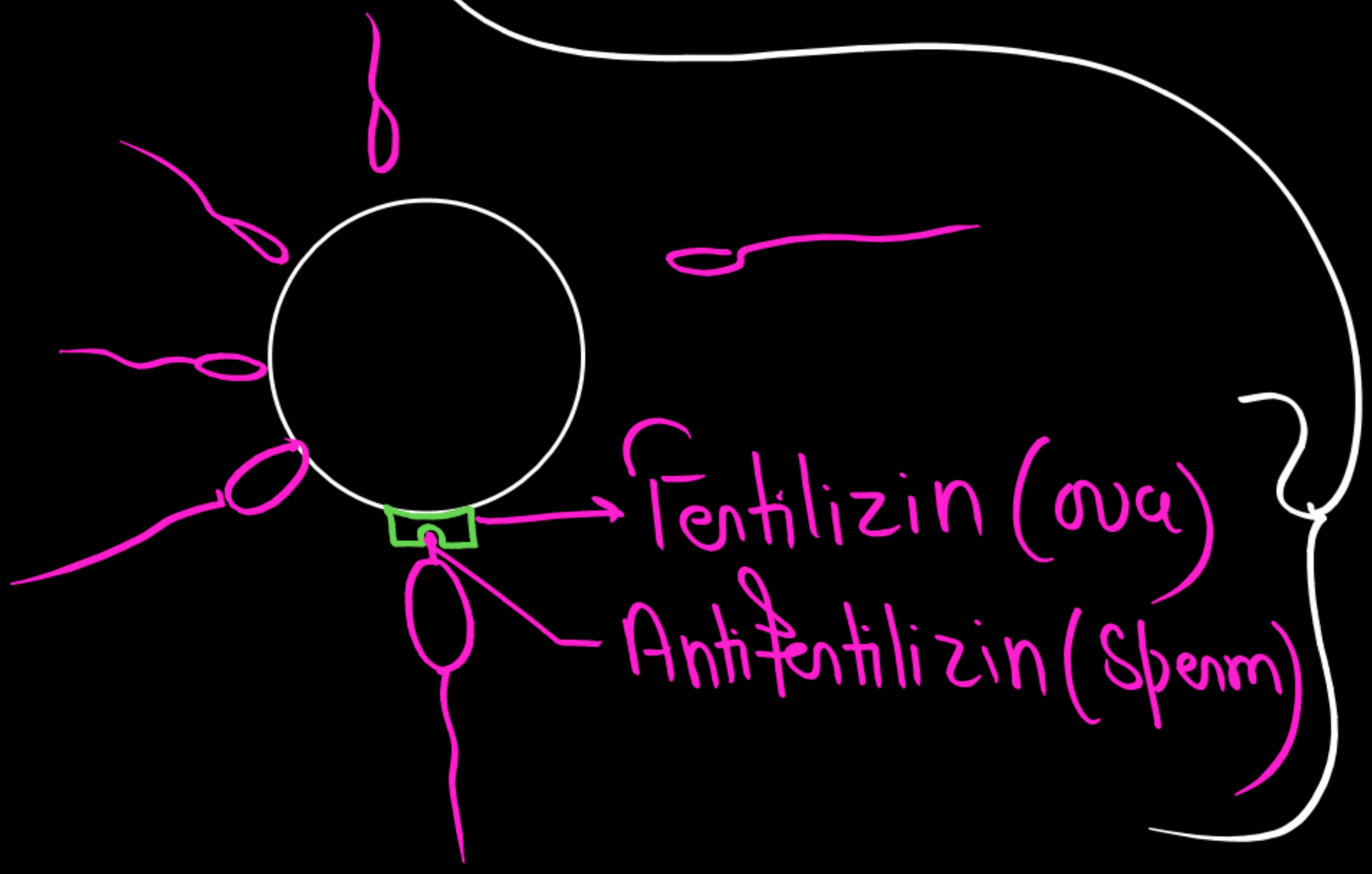
Capacitation –

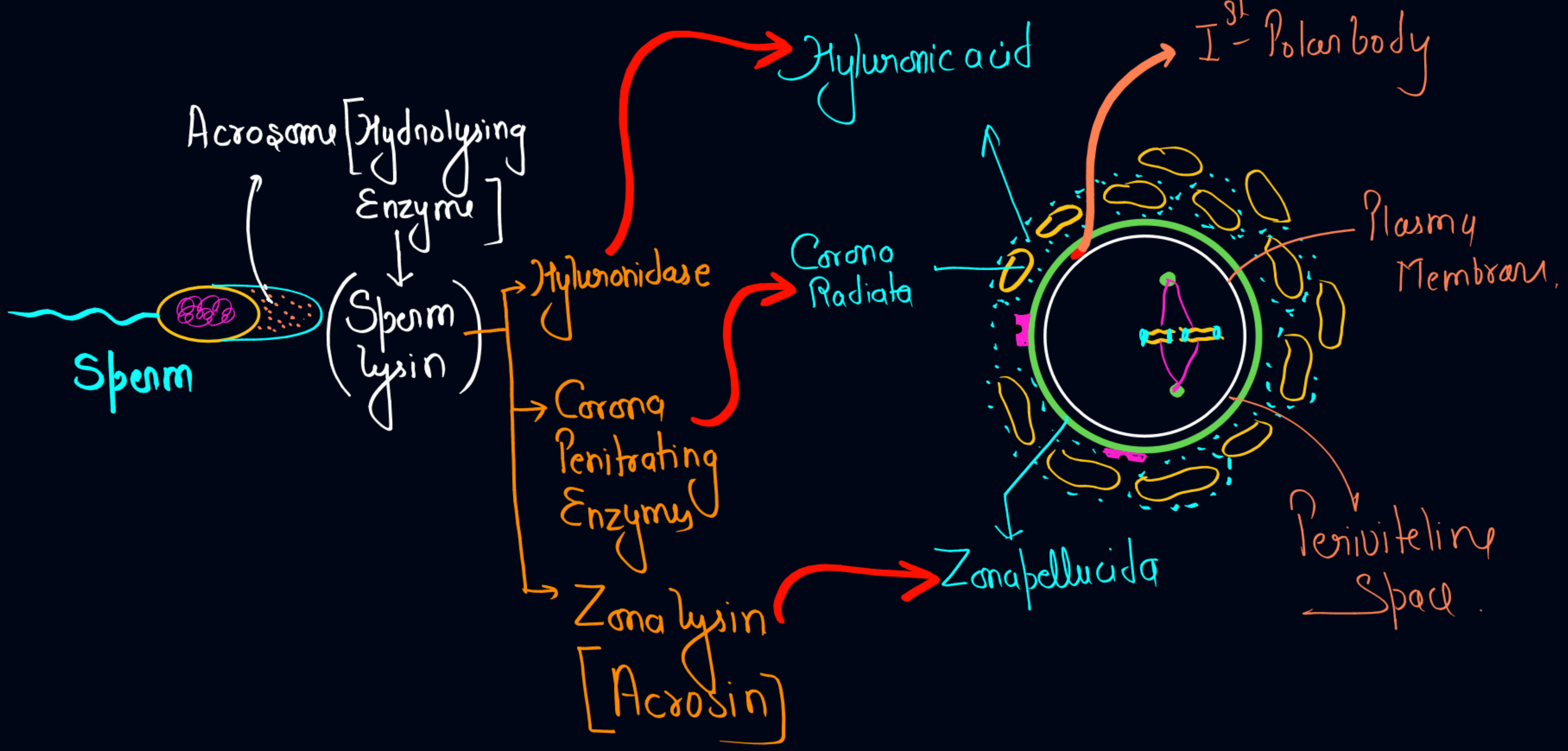
(Rearrangement of glycoproteins in PM of sperm)

Activation of sperm after ejaculation in vaginal tract-

1. Removal of cholesterol, glycoproteins, and proteins from the plasma membrane around the head of the sperm.
2. Dilution of Decapacitation factors.
3. Entry of Ca+ into sperm causing motile sperms swim rapidly, pass through the cervix, enter into the uterus and finally reach the ampullary region of the fallopian tube, where fertilization takes place.

Acrosomal Reaction – In this reaction no. of sperms (250) attach to surface of egg (agglutination) and acrosome start releasing of hydrolysing enzymes (sperm lysins)





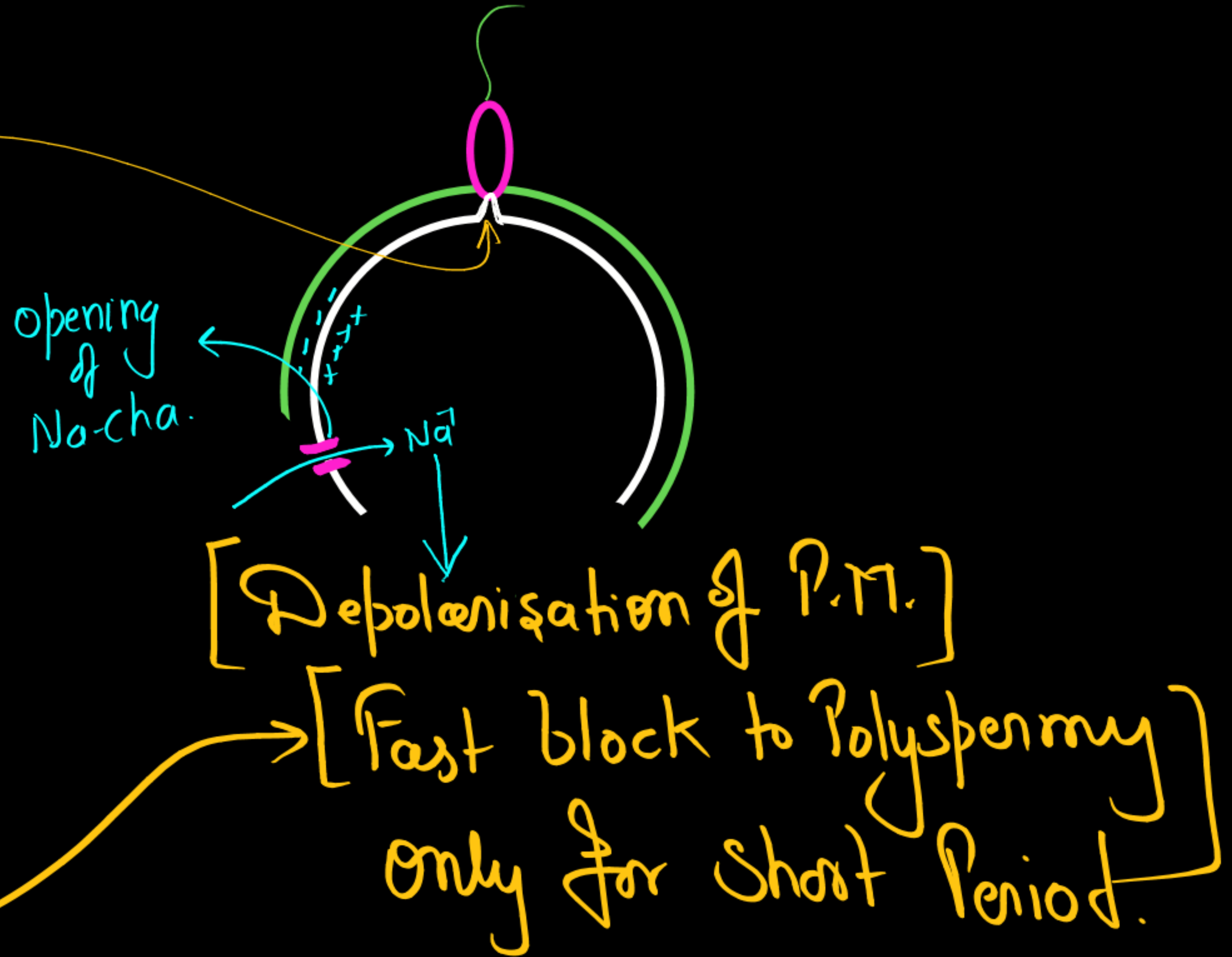
Acrosome [Hydrolysing Enzyme]
Sperm
(Sperm lysin)
Hyluronidase
Corona Penitrating Enzyme
Zona lysin [Acrosin]
Hyluronic acid
Corona Radiata
Zonapellucida
I st - Polar body
Plasma Membrane.
Periviteline Space.

Formation of fertilisation Cone-

Contact of acrosome stimulate development of out growth by PM of oocyte called fertilisation cone / cone of reception to receive the incoming sperm

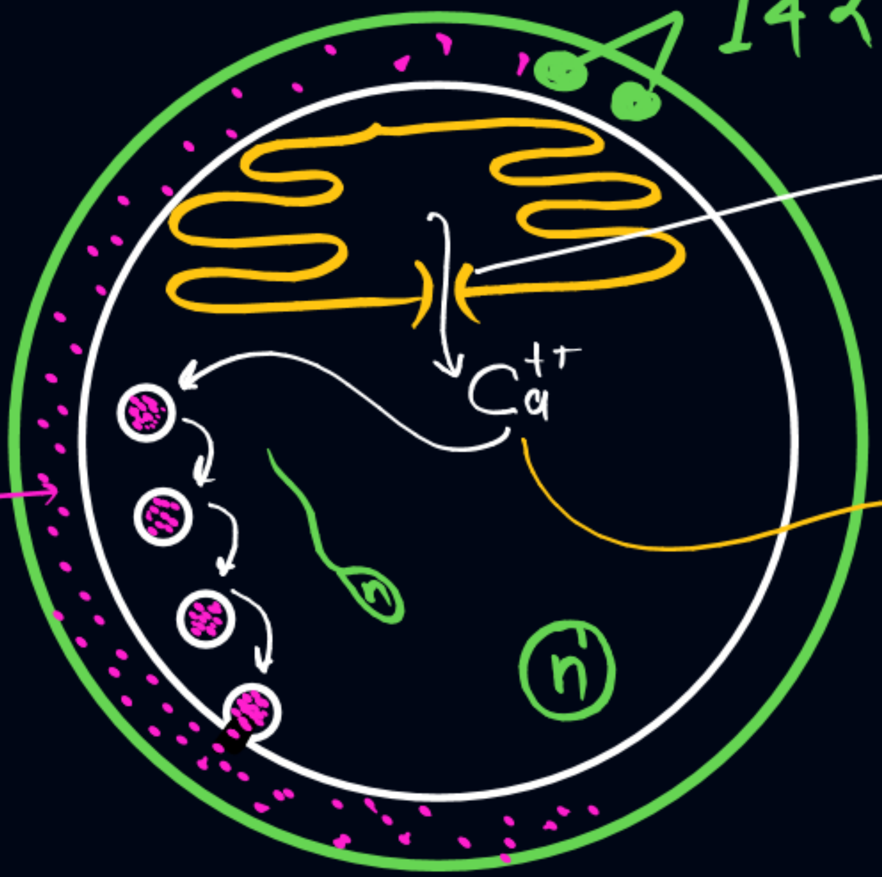
Zona reaction (Fast Block to Polyspermy)

Cortical reaction (slow block to polyspermy)



Cortical Reaction →

Slow block to Polyspermy



1 & 2 Polar body

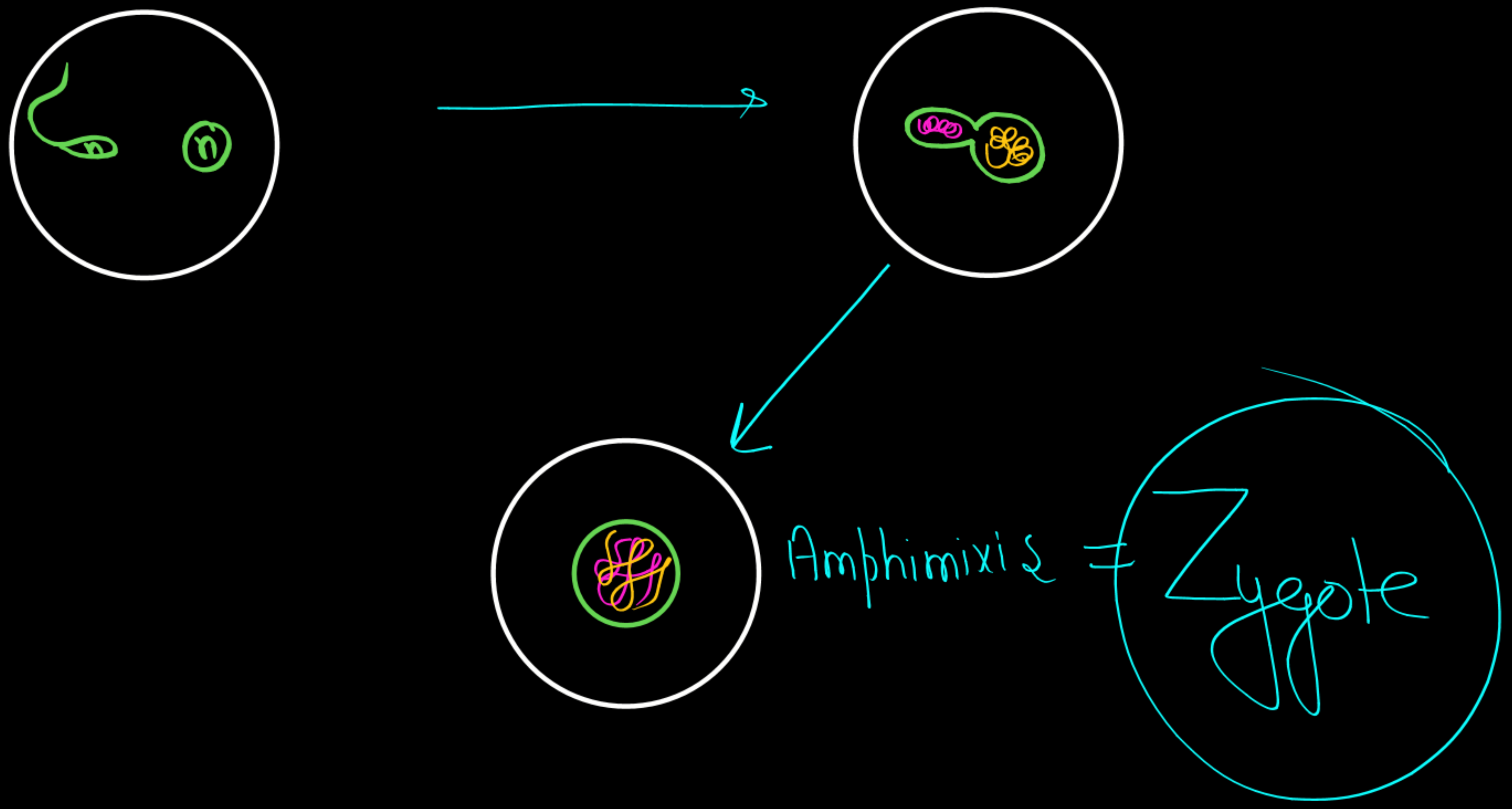
After Depolarisation opening of Ca-channels.

Restart arrested Meiosis (M-II)

Formation of

1) - IInd - Polar body
2) - Female Pronucleus.

Amphimixis-

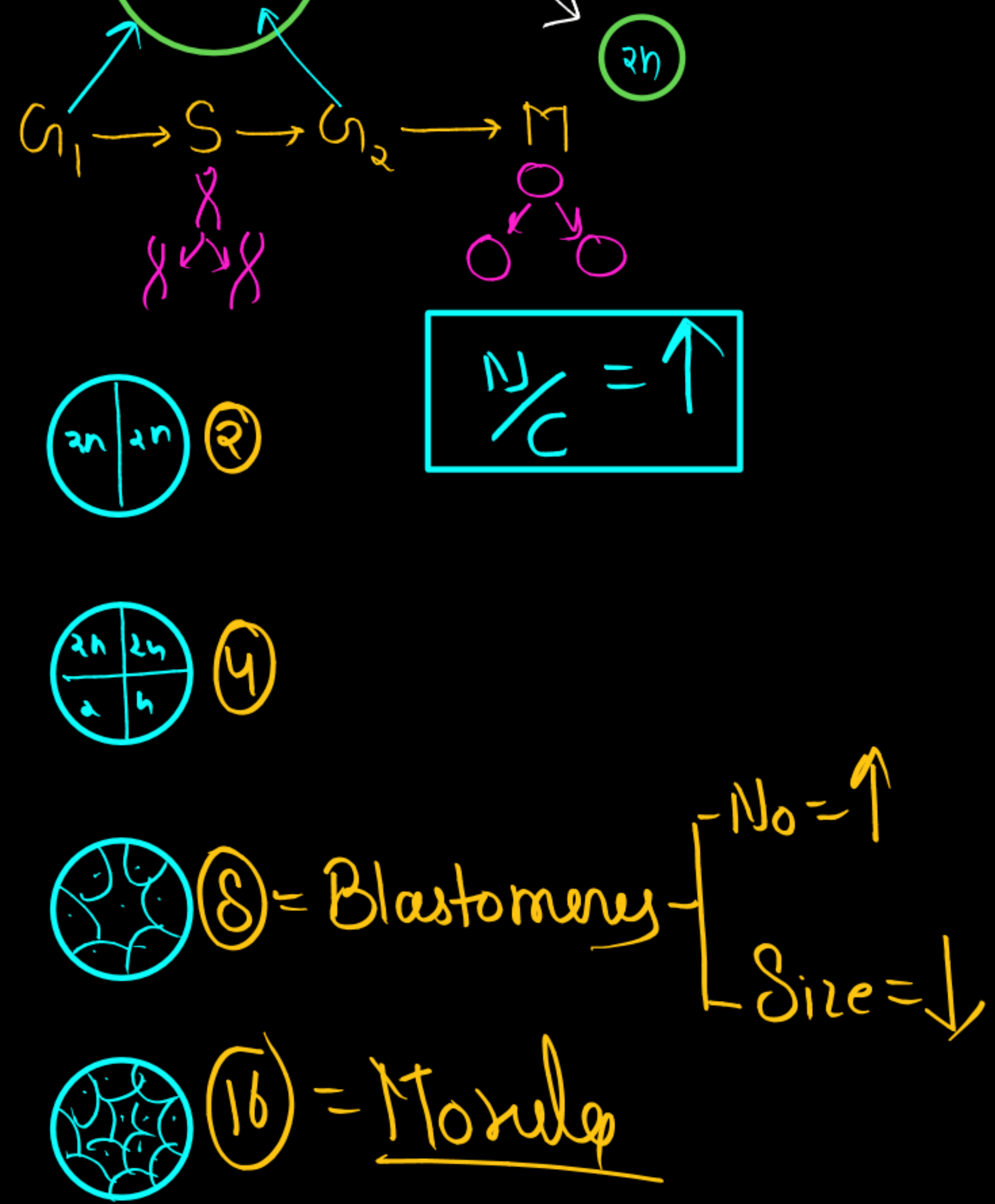


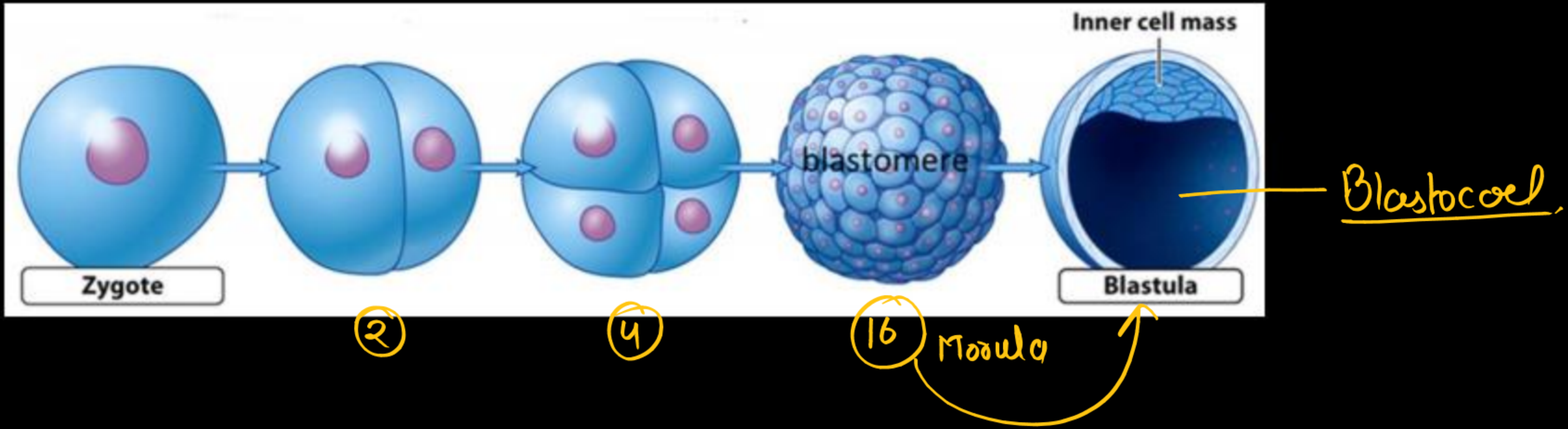
Cleavage -

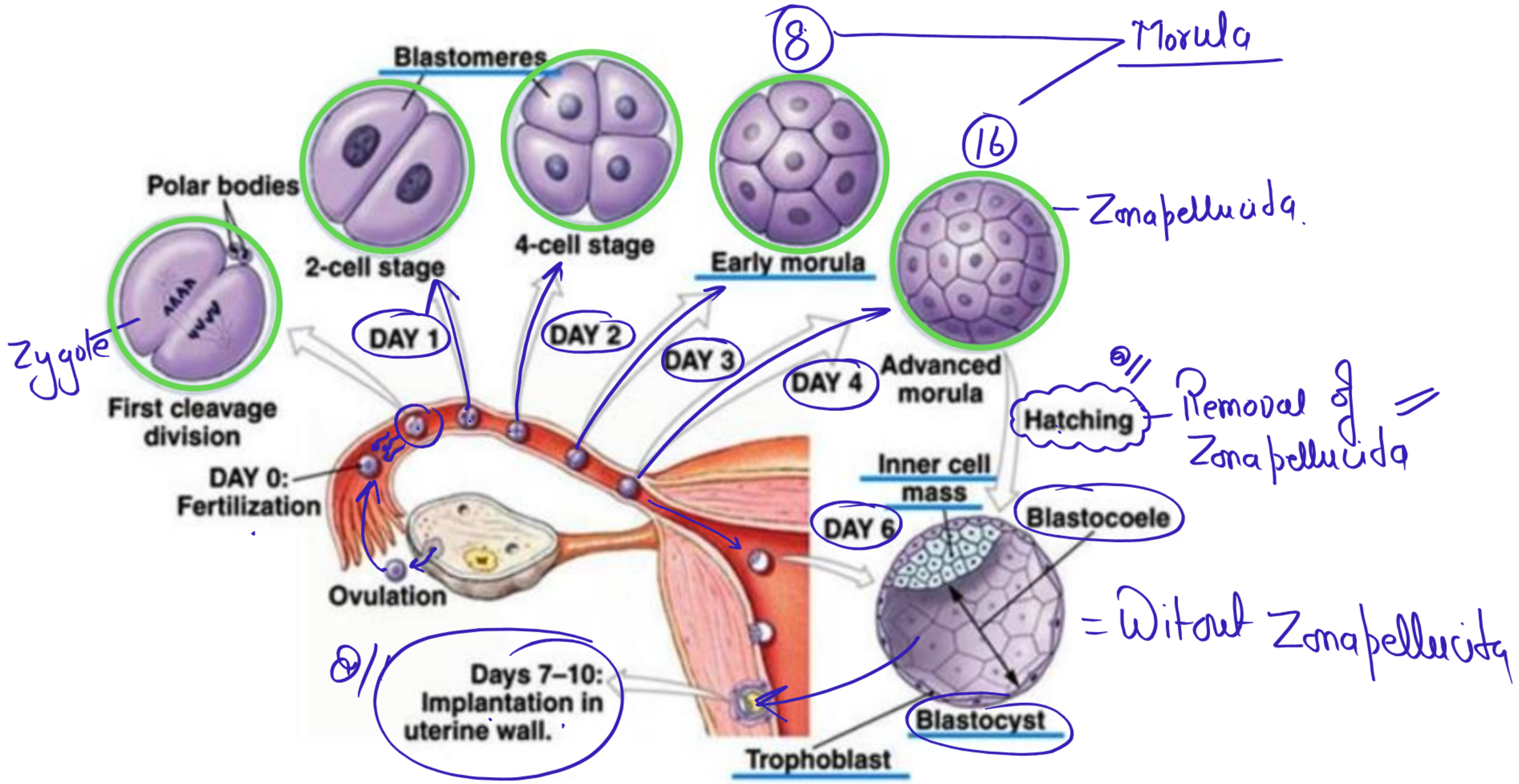
After fertilization, it is a rapid mitotic cell divisions of the zygote, which converts single-celled zygote into multicellular morula.

- During cleavage total size of embryo remains constant due to both growth phase (G1 & G2) are absent.
- Nuclear cytoplasmic ratio increases because -
- Total mass of cytoplasm same → DNA content increase.
- No. of blastomeres increase → Size of blastomere decrease.
- Cleavage ends with the formation of multicellular morula






Inner cell mass
blastomere
Zygote
Blastula
Blastocoel
2
4
16
Morula



Blastomeres
Polar bodies
2-cell stage
4-cell stage
Early morula
Advanced morula
First cleavage division
DAY 0: Fertilization
DAY 1
DAY 2
DAY 3
DAY 4
DAY 6
Ovulation
Hatching
Inner cell mass
Blastocoele
Blastocyst
Trophoblast
Days 7–10: Implantation in uterine wall.
8
16
Morula
Zygote
Zonapellucida
Removal of Zonapellucida
= Without Zonapellucida

THANK YOU !!

MANTHAN NEET

HUMAN REPRODUCTION

LECTURE - 8

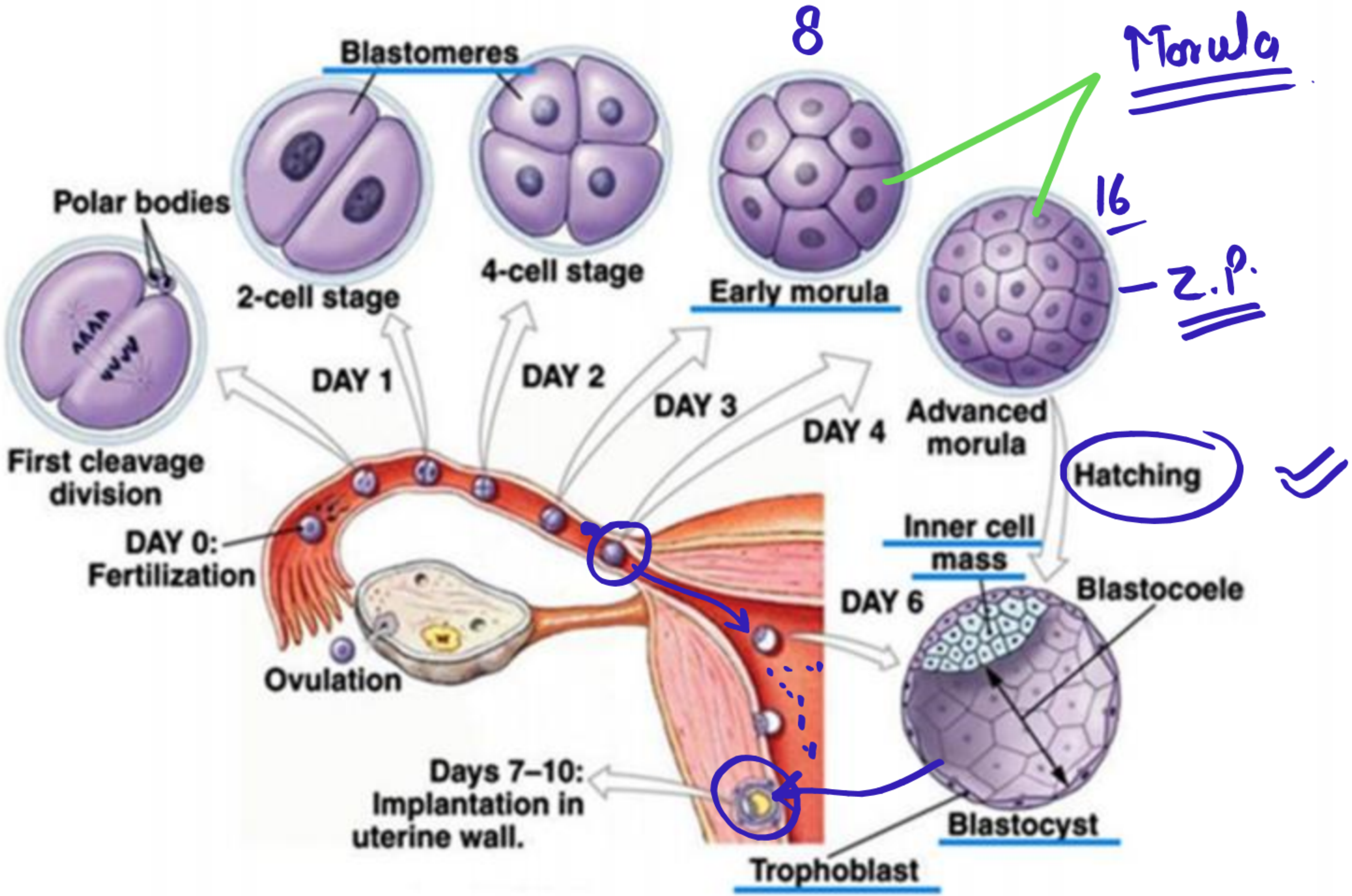
ZOOLOGY



MD SIR

TODAY'S GOAL

- Implantation
- Embryonic development
- Placenta
- Gestation
- Parturition



Blastomeres
Polar bodies
2-cell stage
4-cell stage
Early morula
Advanced morula
First cleavage division
DAY 1
DAY 2
DAY 3
DAY 4
DAY 0: Fertilization
Ovulation
Hatching
Inner cell mass
DAY 6
Blastocoele
Days 7–10: Implantation in uterine wall.
Blastocyst
Trophoblast
8
16
Morula
Z.P.

Hatching (Removal of Zona pellucida)

Necessary for Implantation



Blastula

Trophoblast → Release lytic Enzyme.

Inner cell Mass → Embryo



Cells of Inner Cells Mass
⇓
Convert into Complete Embryo.

Stem cell of Inner cell Mass.

Responsible for formation of Monozygotic Twin.



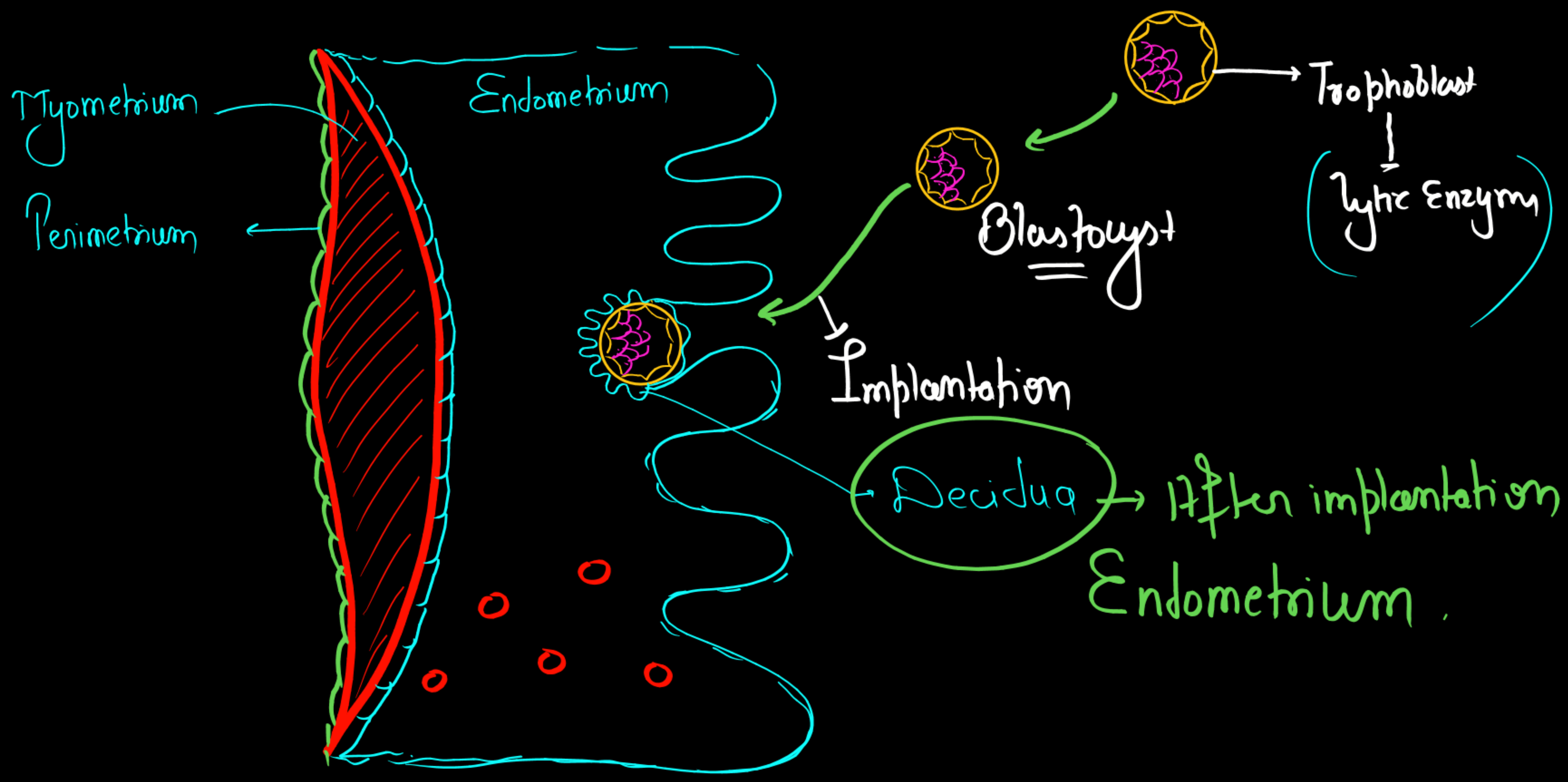
Blastocyst

Trophoblast
Also Release
↓
hCG
↓
if +nt in urine +ve pregnancy Test

Implantation

(7-9 days after fertilization)

- It is attachment or embedding of developing blastocyst with wall of uterus (Endometrium) with the help of lytic enzymes which release from trophoblast of embryo.
- During implantation, blastocyst completely sinks in the wall of uterus and endometrium becomes more vascularized.
- After implantation, the endometrium is known as the decidua.

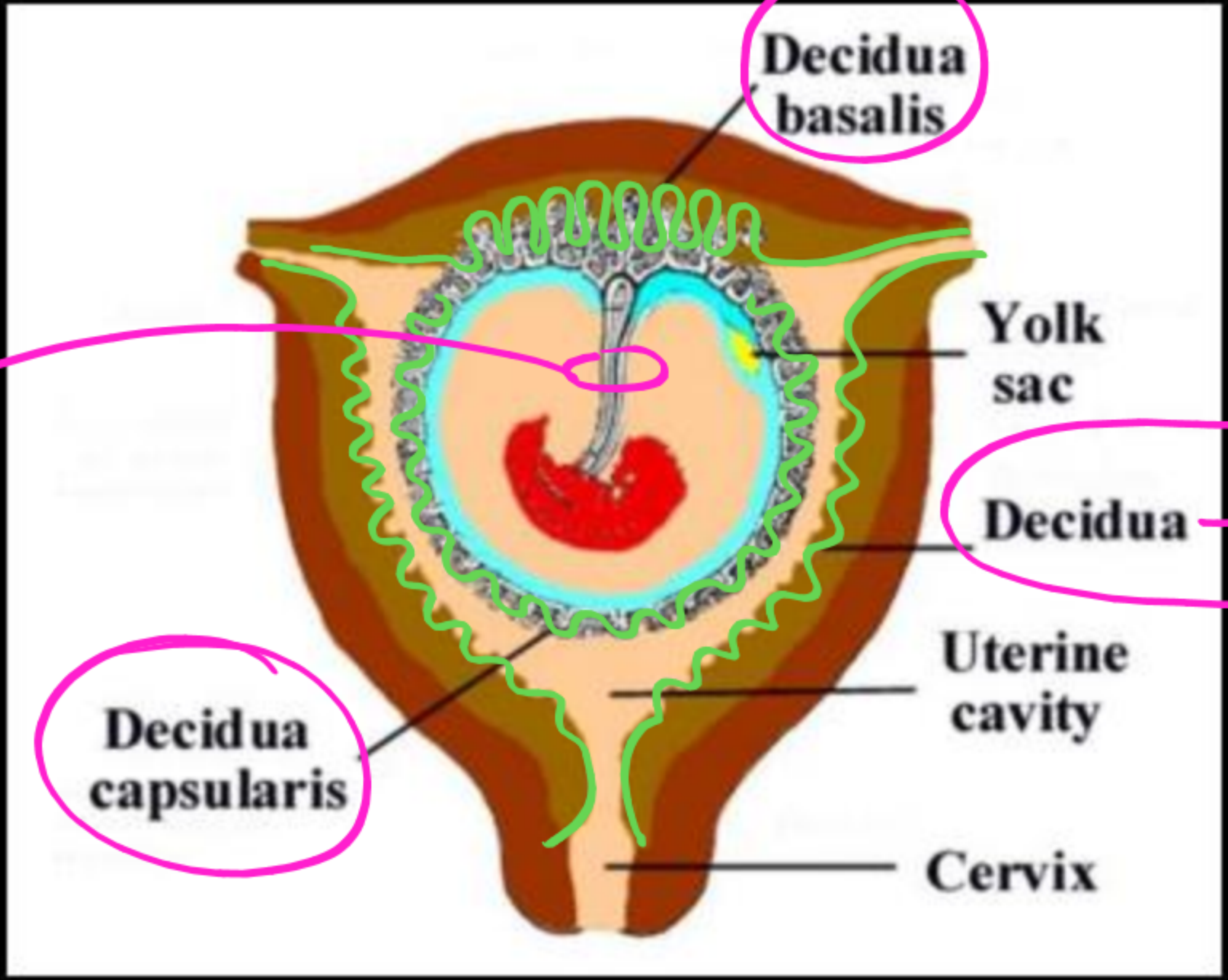


Myometrium
Perimetrium
Endometrium
Trophoblast
Lytic Enzyme
Blastocyst
Implantation
Decidua
After implantation Endometrium.

Types of Decidua

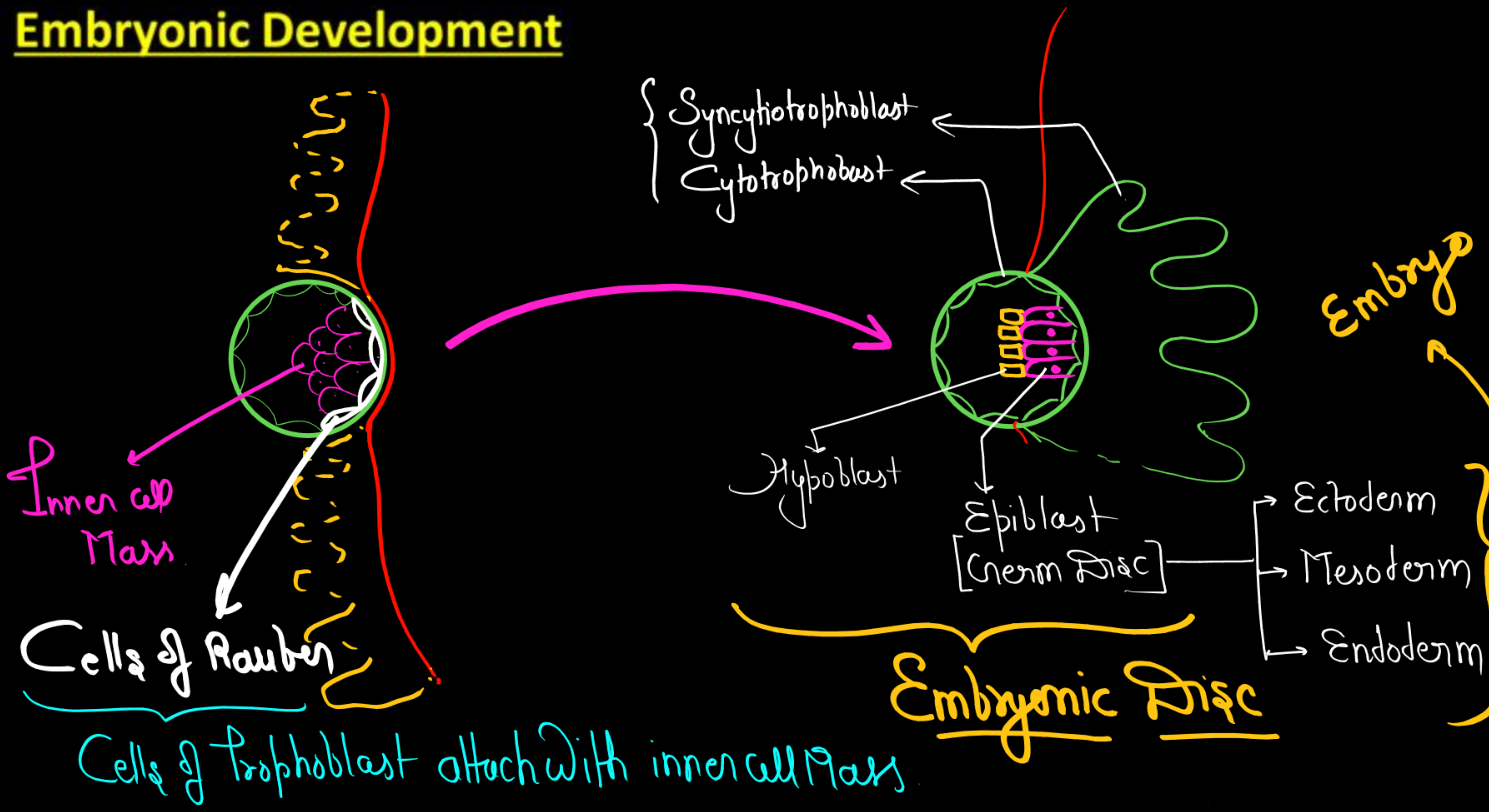
Placenta

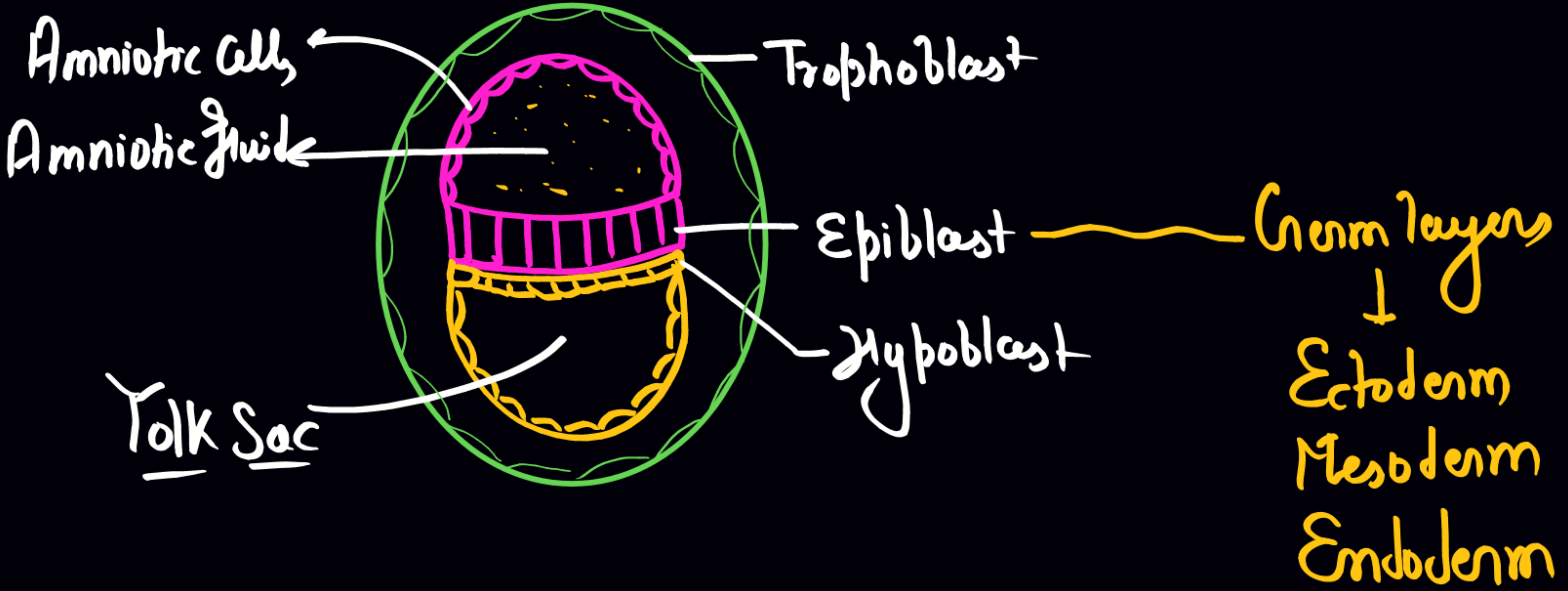
Maternal + Foetal



Umblical Cord → Embryo

Embryonic Development

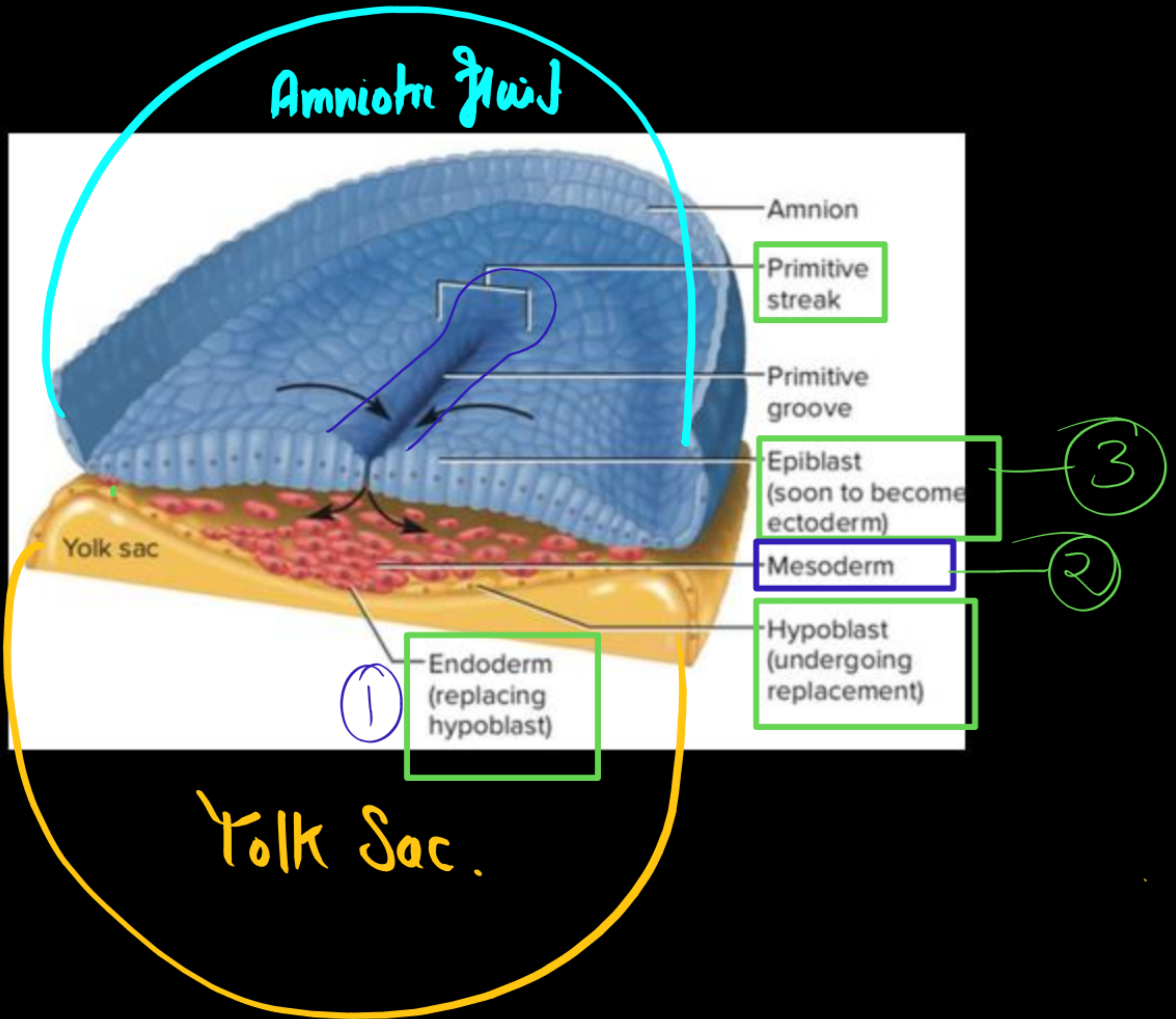



Amniotic cells
Amniotic fluid
Trophoblast
Epiblast
Hypoblast
Yolk Sac
Germ layers
Ectoderm
Mesoderm
Endoderm

Gastrulation

- It is the first major event of the third week of development.
- It occurs about 15 days after fertilization.
- In this process, the bilaminar embryonic disc, consisting of epiblast and hypoblast, transforms into a trilaminar embryonic disc consisting of three primary germ layers:

➢ Ectoderm
➢ Mesoderm
➢ Endoderm



Amniotic fluid
Amnion
Primitive streak
Primitive groove
Epiblast (soon to become ectoderm)
3
Mesoderm
2
Hypoblast (undergoing replacement)
Yolk sac
1
Endoderm (replacing hypoblast)
Yolk Sac.

Ectoderm	Mesoderm	Endoderm
Epidemis	Dermis	Gut
Cutaneous glands	Muscular tissue	Visceral organs
Nervous system	Connective tissue	Glands of stomach and intestine
(Brain and spinal cord)	Endoskeleton	Tongue
Eye (Retina, lens and cornea)	Vascular system	Lungs, trachea and bronchi
Nasal epithelium	(heart and blood vessels)	Urinary bladder
Internal ear	Kidneys	Gills
Lateral line sense organ	Gonads	Liver and pancreas
Stomodaeum	Urinary and genital ducts	Thyroid gland
Proctodacum	Coelom and coelomic epithelium	Parathyroids
Pituitary	Choroid and sclerotic coats of eye	Thymus
Pineal gland	Adrenal cortex	Middle ear
Adrenal medulla	Spleen	Eustachian tube

THANK YOU !!

MANTHAN NEET

HUMAN REPRODUCTION

LECTURE - 9

ZOOLOGY

SANKALP NEET
VEDANTU



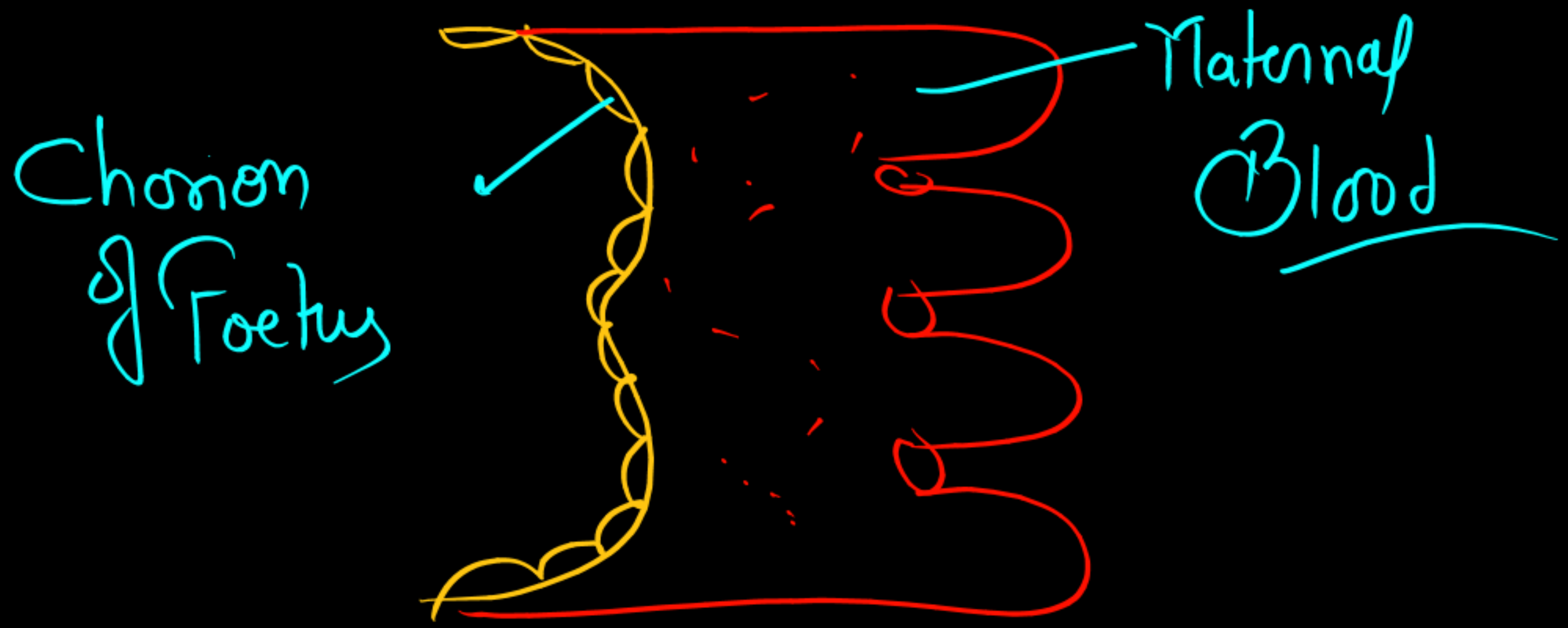
MD SIR

TODAY'S GOAL

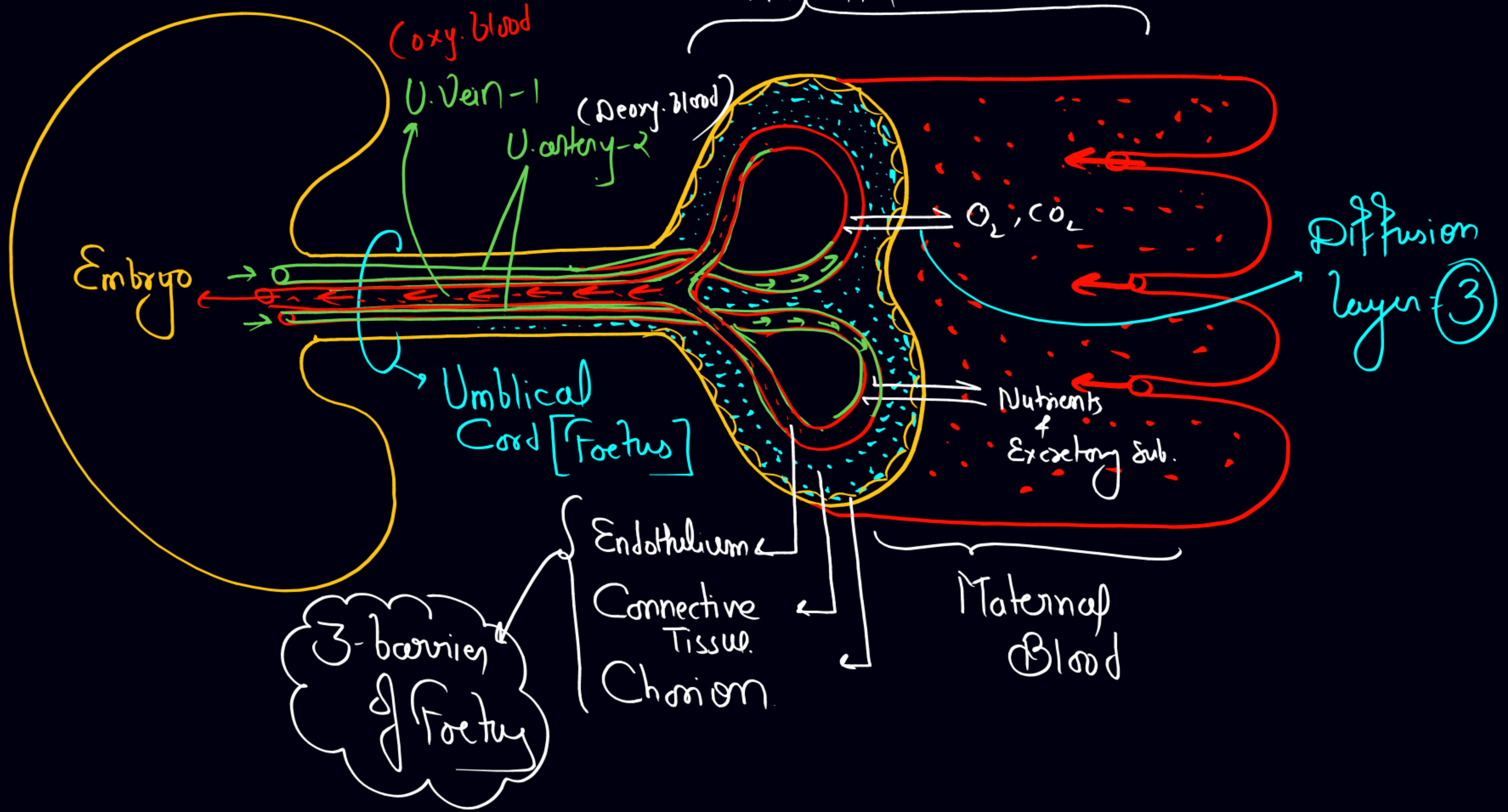
- ❑ Placenta
- ❑ Gestation
- ❑ Parturition

Placenta – (Maternal + Foetal)

- It is a structural and functional unit b/w developing embryo and maternal body
- Types of placenta in Human –
- Haemochorial Placenta- Placenta in which the maternal blood is in direct contact with the chorion of foetus.



Placenta = Haemochorial Placenta



Function of Placenta

(1) Placenta act as endocrine gland and release following hormones-

- Estrogen
- Progesterone
- Human chorionic gonadotrophin (hCG)
- Chorionic thyrotrophin
- Chorionic corticotrophin
- Human placental lactogen (hPL) hormone or chorionic somatomammotrophin
- Relaxing

(2) Placenta act as an ultrafilter through which -

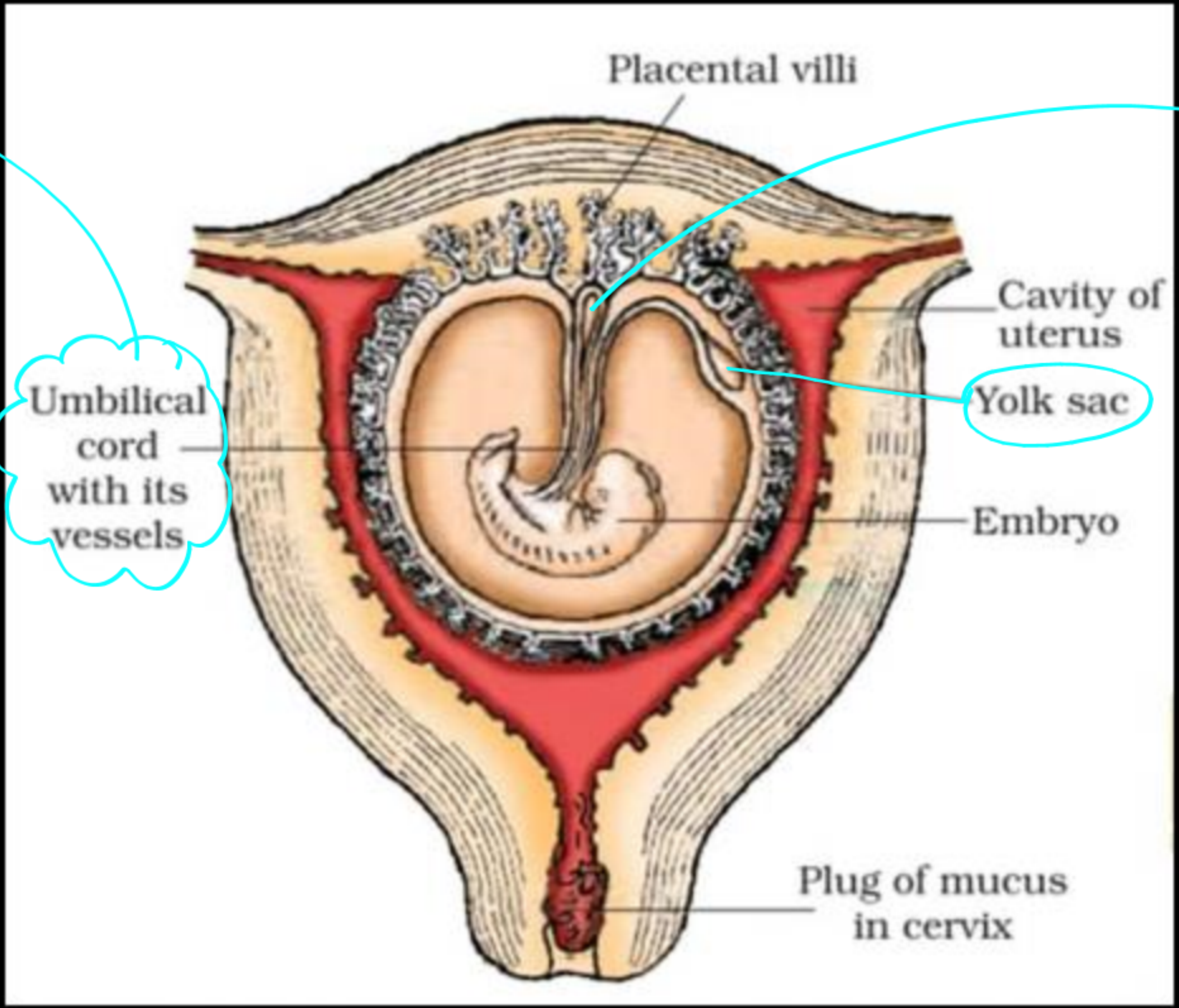
- Soluble inorganic and organic material
- Nutrients
- Hormones
- Gases
- Antibody against diphtheria, smallpox and measles etc. can pass from mother to foetus.

(3) Virus infection of the mother eg Rubella virus (German measles) etc. and certain chemicals (teratogens) may cause malformation in developing embryo.

U. Artery
U. Vein
Allanteis
Yolk Sac.
Conn. Tissue,

↓

Foetuy



Allanteis

Gestation Period-

- It is a duration b/w Fertilization to Parturition (Child birth)
- In Human – 9 month/38 week/266 days/280 days from last menstrual
- It divided in to 3 trimester.

First trimester (3 month)

- **First month** - The first sign of growing foetus may be noticed by listening to the heart sound carefully through the stethoscope.
- **Second month** - The foetus develops limbs and digits.
- **Third month** - By the end of 12 weeks (first trimester), most of the major organ systems are formed, for example, the limbs and external genital organs are well-developed.

Second Trimester

- The first movements of the foetus and appearance of hair on the head are usually observed during the fifth month.
- By the end of 24 weeks (second trimester), the body is covered with fine hair (Lanugo), eyelids separate, and eyelashes are formed.

Third Trimester

- By the end of nine months of pregnancy, the foetus is fully developed and is ready for delivery.

Note -

Gestation Period of –

Dog	–	60-65 days
Cat	–	52-65 days
Elephant	–	607-641 days

Parturition

- Vigorous contraction of the uterus at the end of pregnancy causes expulsion/delivery of the foetus. This process of delivery of the foetus (childbirth) is called parturition (Labor).
- Parturition is induced by a complex neuroendocrine mechanism.
- Signals for parturition originate from the fully developed fetus & placenta.
- There is induction of mild uterine contractions called foetal ejection reflex. This triggers release of oxytocin from the maternal pituitary.

During Pregnancy level of Progesterone = ↑

↓

Inhibit →
- Uterine Contraction
- GnRH < LH, FSH.
- Menstrual cycle.

At the end of Gestation Period →

[Placenta = Weak.]

↓

[↓ - Level of Progesterone]

Placenta Release → **C.R.H.**

↓

Pituitary → ACTH → Adrenal Cortex

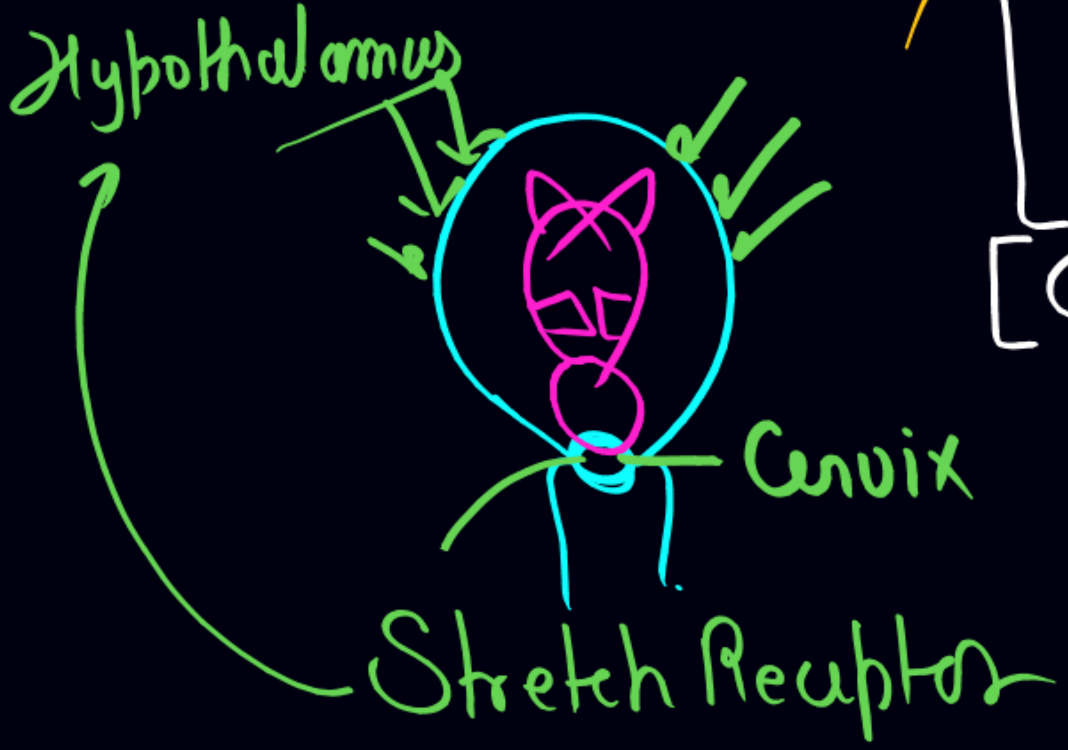
Adrenal Cortex

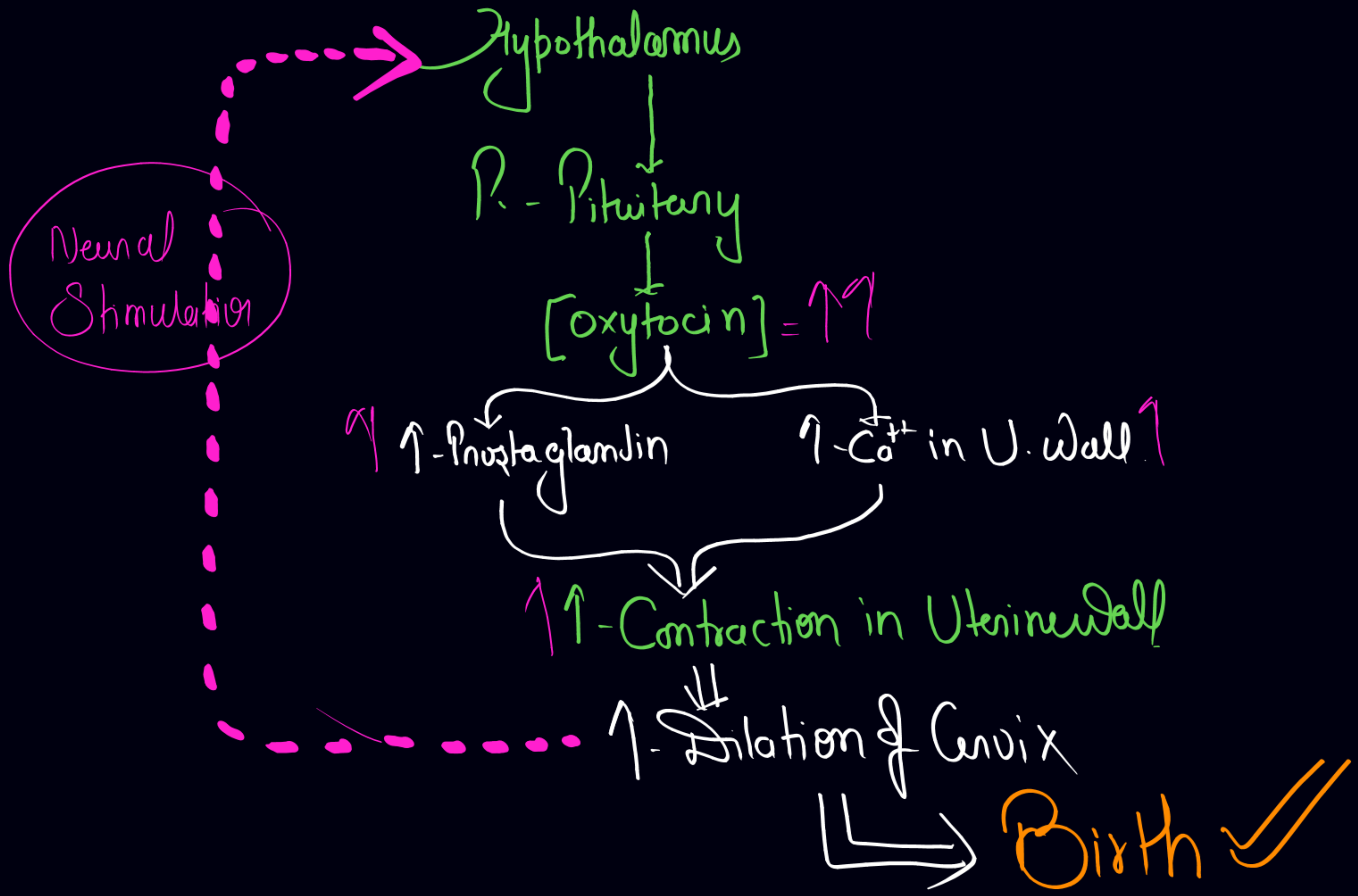
Cortisol
↓
Repair lungs of Foetus

D.H.E.A (Androgen)
Convert
Estrogen ↑

Or
[Prostaglandin]
↓
[Contraction in Smooth Mus.]
⇓
Mild Contraction in Uterine Wall
↳ Foetus Ejection Reflex

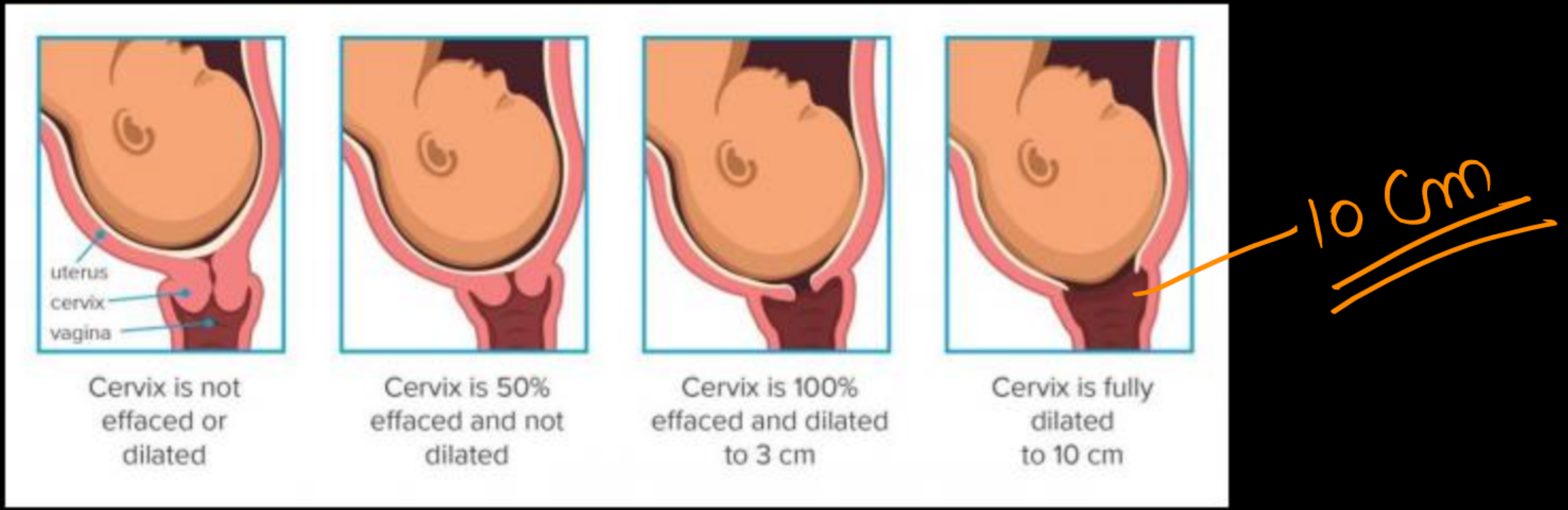
Formation of oxytocin Receptor on Uterine Wall



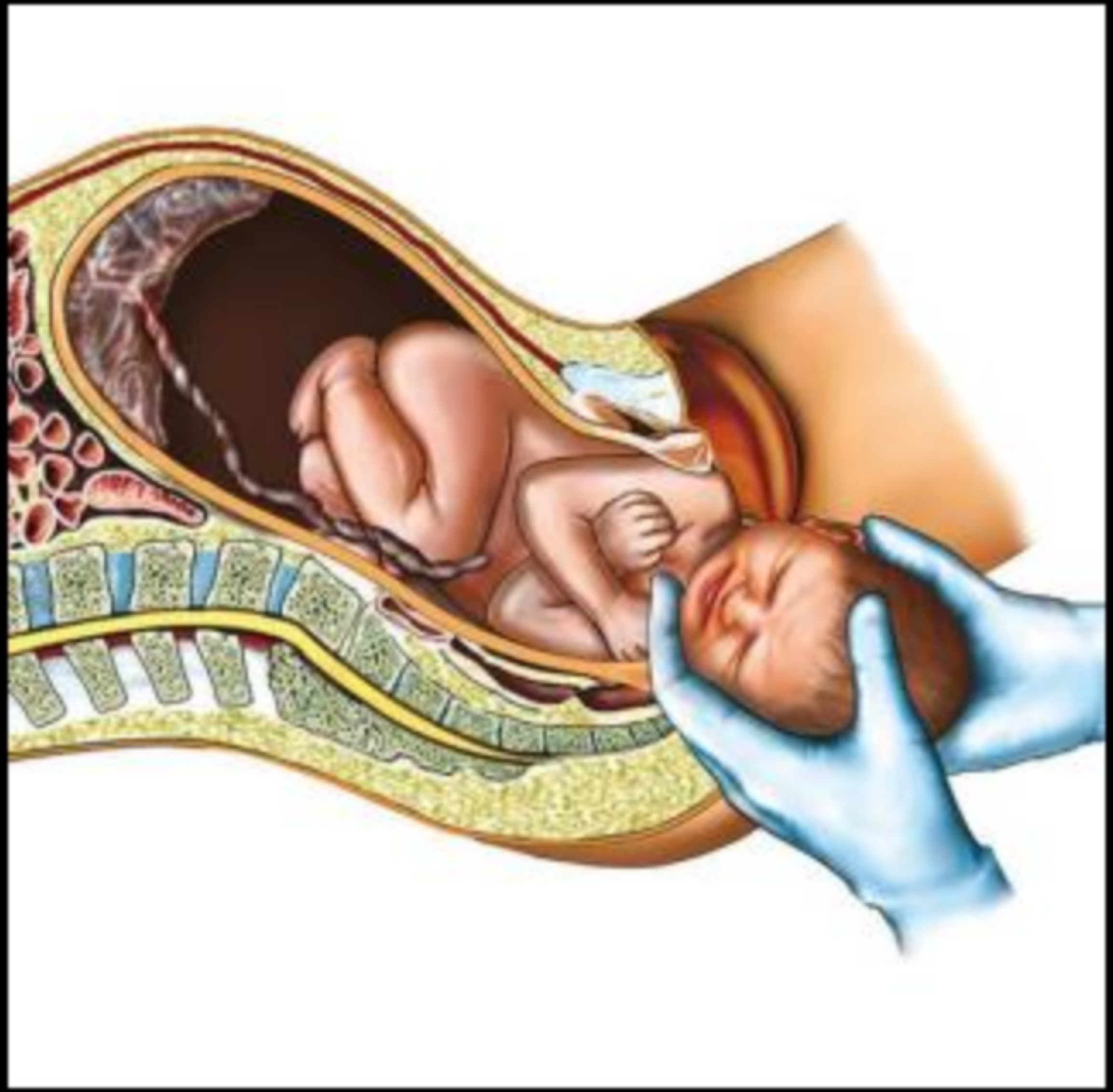

Hypothalamus
P. - Pituitary
[Oxytocin] = ↑↑
↑↑ ↑-Prostaglandin
↑-Ca^{++} in U. Wall ↑
↑↑-Contraction in Uterine wall
↑-Dilation of Cervix
Birth ✓
Neural Stimulation

Stages of Parturition

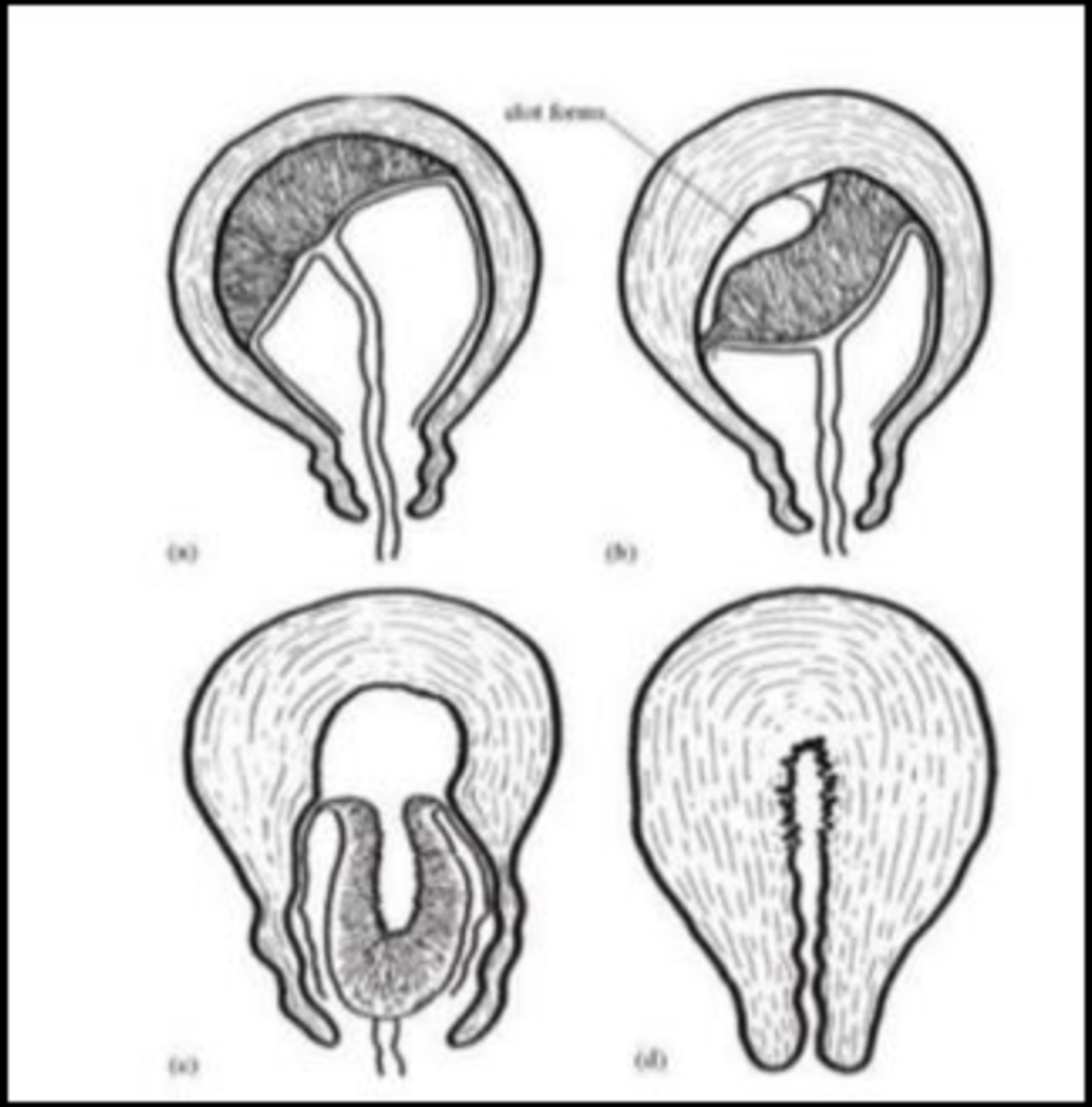
1. Stage of Dilation (6–12 hours)



2. **Stage of Expulsion** (10 minutes to several hours)



3. Placental stage




U.Cord
Placenta,



THANK YOU !!

MANTHAN NEET

REPRODUCTIVE HEALTH

LECTURE - 1

ZOOLOGY



MD SIR

TODAY'S GOAL

- Reproductive Health – Problems and Strategies

Reproductive Health

According to the World Health Organisation (WHO) Geneva, reproductive health means a total well-being in all aspects of reproduction, i.e.,

- Physical
- Emotional
- Behavioural
- Social.

Reproductively Healthy Society

A society with people having - physically and functionally normal reproductive organs and normal emotional and behavioral interactions among them in all sex-related aspects might be called reproductively healthy society.

Reproductive Health – Problems and Strategies

- India was amongst the first countries in the world to initiate action plans and programes at a national level to attain total reproductive health as a social goal. These programes called 'family planning' were initiated in 1951.
- Improved programes covering wider reproduction-related areas are currently in operation under the popular name 'Reproductive and Child Health Care (RCH) programs'.

Objectives of Reproductive and Child Health Care (RCH) Programmes

Awareness about reproduction-related aspects

- With the help of audio-visual and the print-media, governmental and nongovernmental agencies have taken various steps to create awareness.
- A major role is also played by – parents, close relatives, teachers, friends.
- Introduction of sex education in schools should also be encouraged.

Proper information should be provided about-

- Reproductive organs ✓
- Adolescence and related changes ✓
- Safe and hygienic sexual practices
- Sexually transmitted diseases (STD)
- AIDS

Strategies-

People, especially fertile couples and those in marriageable age group, should be educated about-

- Available birth control options (contraceptive methods)
- Care of pregnant mothers.
- Postnatal care of the mother and child
- Importance of breast feeding.
- Equal opportunities for the male and the female child.
- Awareness of problems due to uncontrolled population growth.
- Social evils like sex-abuse and sex-related crimes

Successful Implementation

Successful implementation of various action plans to attain-

- Infrastructural facilities
- Professional expertise
- Material support

These are essential to provide medical assistance and care to people in reproduction-related problems like-

- Pregnancy, delivery, STDs, abortions, contraception, menstrual problems, infertility, etc.

Implementation of better techniques-

- Statutory ban on amniocentesis for sex-determination to legally check increasing menace of female foeticides, massive child immunization, etc., are some programes that merit mention in this connection.

Amniocentesis-

- A procedure performed during pregnancy to obtain amniotic fluid to test for chromosomal abnormalities and fetal infections.

Conditions it may diagnose: This procedure is used to test for the presence of certain genetic disorders such as, **down syndrome, haemoplilia, sickle-cell anemia, muscular dystrophy** etc., and determine the survivability of the foetus.

Misuse of Amniocentesis –

It is being used to kill the normal female foetus.

Procedure –

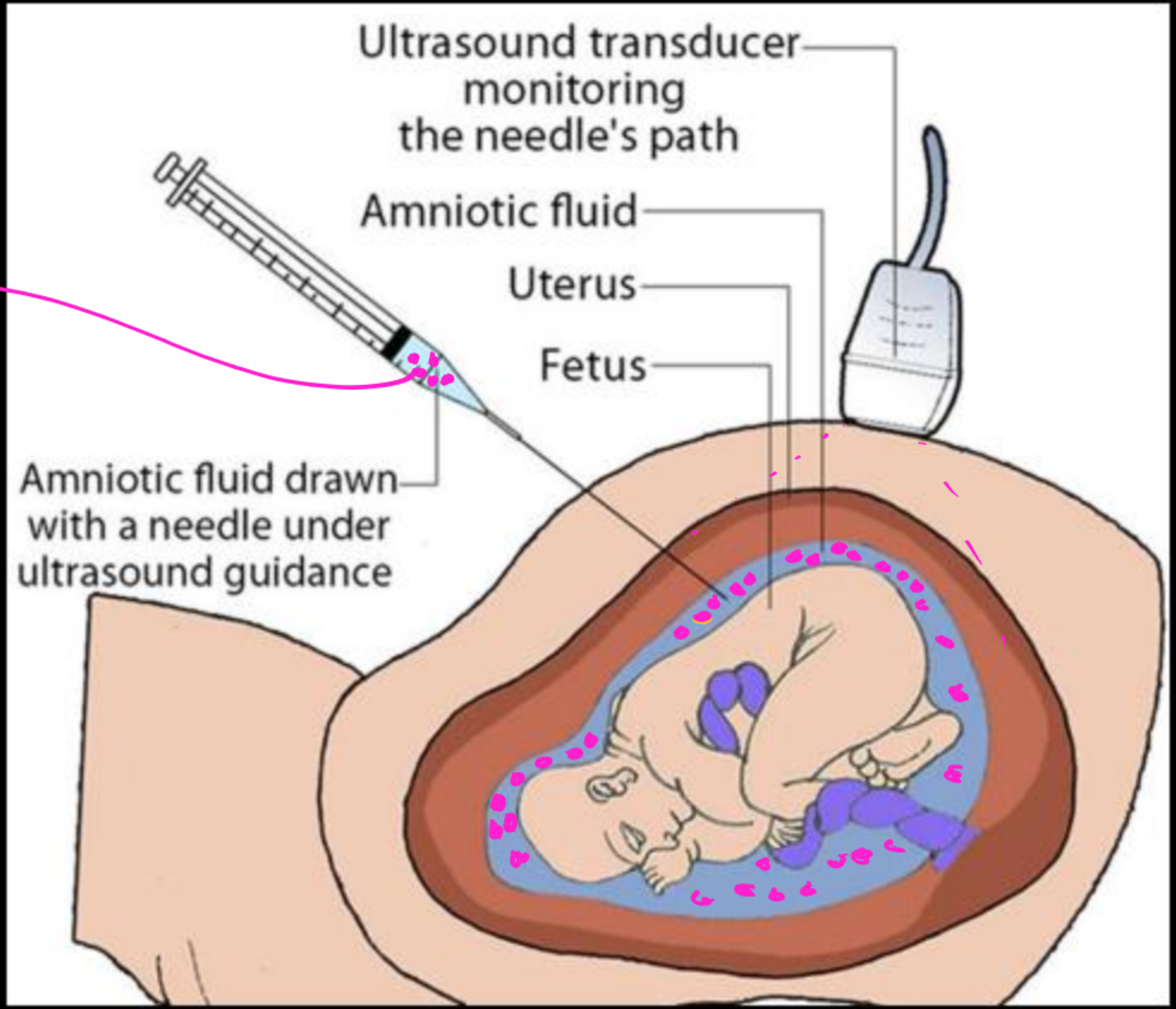
The test usually done
at 14-18 weeks of gestation

@//

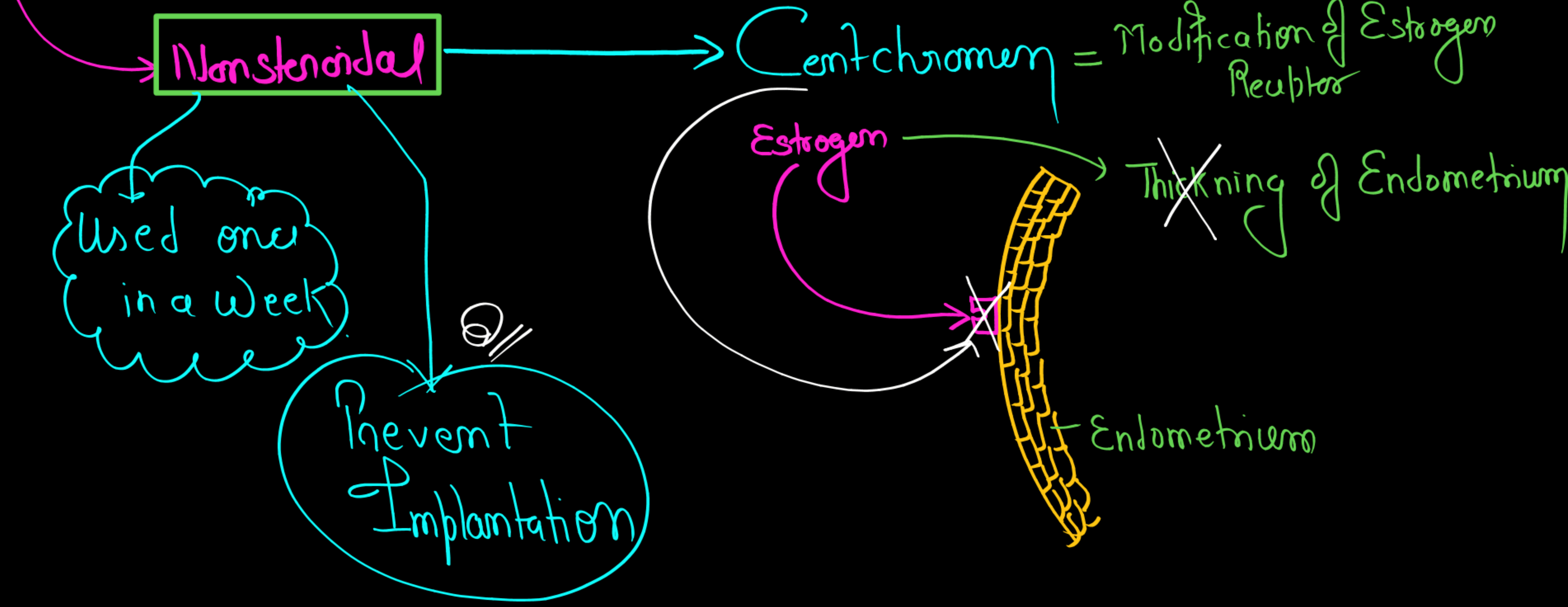
46-Chro.

44

XX
or
XY



'Saheli'– a new oral contraceptive for the females–was develope by scientists at Central Drug Research Institute (CDRI) in Lucknow, India.



Indicators of improved reproductive health of the society –

- Better awareness about sex related matters.
- Increased number of medically assisted deliveries.
- Better postnatal care leading to decreased maternal and infant mortality rates.
- Increased number of couples with small families.
- Better detection and cure of STDs.
- Overall increased medical facilities for all sex-related problems.

THANK YOU !!

MANTHAN NEET

REPRODUCTIVE HEALTH

LECTURE - 2

ZOOLOGY



MD SIR

TODAY'S GOAL

- ❑ Population explosion ✓
- ❑ Contraception methods ✓

Population Explosion-

Population-

- Total no of individual of a species present in a given area at a particular time.
- World Population Day- 11 July

Demography –

Study of population.

Unit of population – Individual



Official counting of population – Census

(undertaken every 10 years)

In India -

1st census – 1872

Last census - 2011 or 2021

The world population which was around -

In 1900 - 2 billion (2000 million)

In 2000 - 6 billion

In 2011 - 7.2 billion.

The India population - which was approximately 350 million at the time of our Independence.

In 2000 1 billion

In 2011 1.2 billion

Ratio of world : India = 6 :1 (according to 2001 census)

(Every sixth person in the world is an Indian)

- According to the 2001 census report, the population growth rate was still around 1.7 per cent, i.e., 17/1000/year.

- According to the 2011 census report, the population growth rate was less then 2 per cent, i.e., 20/1000/year.

Reasons for Population Explosion-

(1) A rapid decline in-

I. Death rate

II. Maternal mortality rate (MMR)

III. Infant mortality rate (IMR)

(2) Increase in number of people in reproducible age

Female → 15-44 Year

Population growth rate depend upon –

1. Birth rate (Fertility rate)
2. Death rate (Mortality rate)
3. Migration
4. Age and Sex ratio



Note –

- The no. of female individuals in a active reproductive age (15-44 years) influences the birth rate.

- Through our Reproductive Child Health (RCH) programme, though we could bring down the population growth rate, it was only marginal.

NOTE-

Demographic Transition - Zero population Growth

BR = DR

BR + Immigration = DR + Emigration

If BR > DR = +ve population growth
If BR < DR = - ve population growth

The most important step to overcome this problem

- Motivate smaller families by using various contraceptive methods.
- You might have seen advertisements in the media as well as posters/bills, etc., showing a happy couple with two children with a slogan Hum Do Hamare Do (we two, our two).
- Many couples, mostly the young, urban, working ones have even adopted an 'one child norm'.
- Statutory raising of marriageable age of the female to 18 years and that of males to 21 years, and incentives given to couples with small families.






Contraception methods
Condom
Female condom
Oral contracepion
Hormonal ring
UID
Contraceptive injection
Surgical sterilization
Implant
Coitus interruptus
Calendar rhythm method
Vaginal douche
Contraceptive patch
Diaphragm / cap

Property of Ideal contraceptive

- User-friendly,
- Easily available
- Effective and reversible with no or least side-effects.
- It also should in no way interfere with the sexual drive/ desire.

(A) Temporary Method-

(1) Natural Methods of Contraception

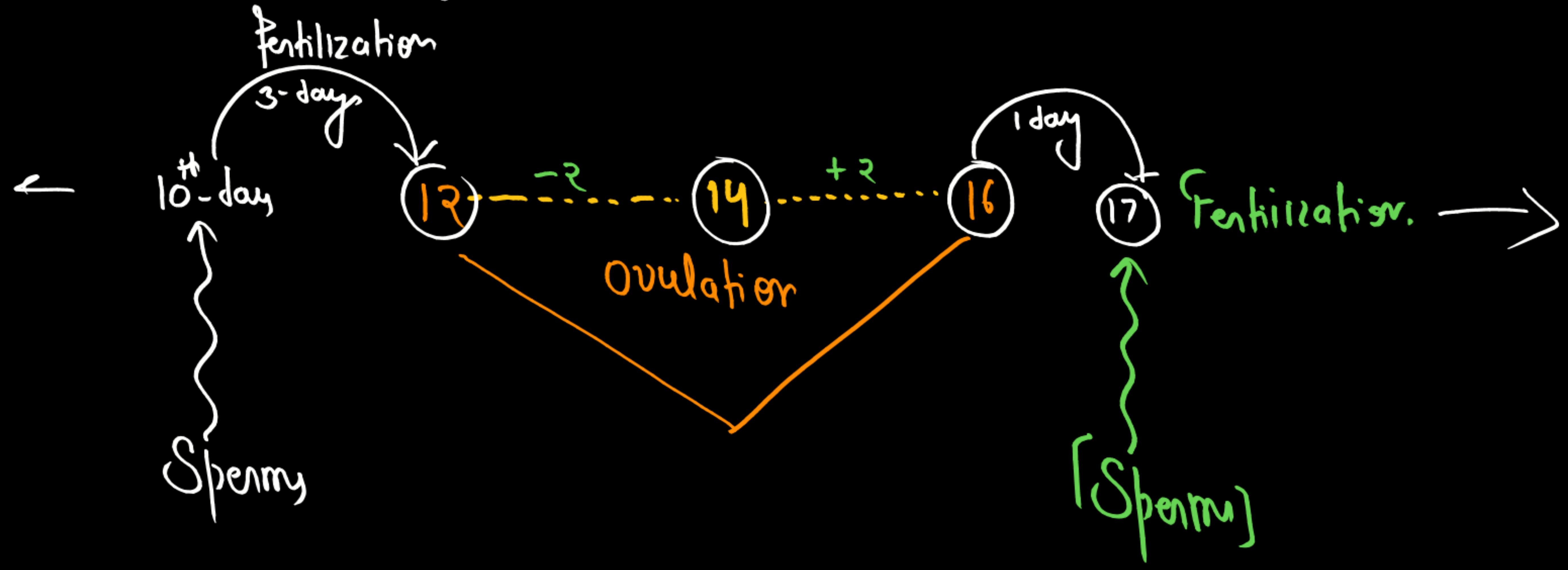
These work on the principle of avoiding chances of ovum and sperms meeting

- Rhythm Method or Safe period or Periodic abstinence or Calendar Method
- Withdrawal Method or Coitus Interruptus (High failure Rate)
- Lactational Amenorrhoea

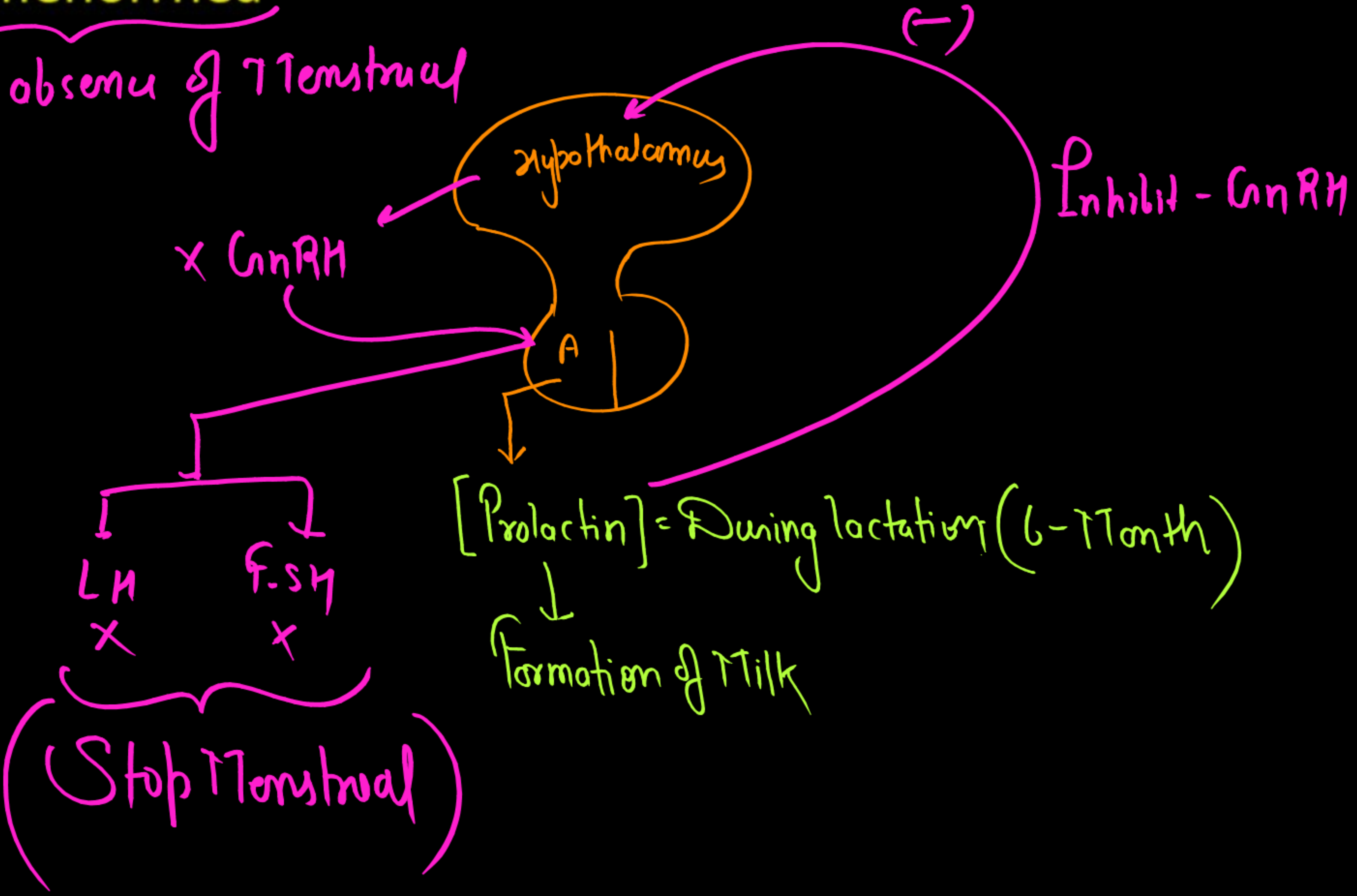
Rhythm Method or Safe period or Periodic abstinence or Calendar Method

Safe Period = Before = 10th - day of Menstrual
After = 17th - day of Menstrual

- After Ejaculation
  Life of Sperms = 3 - days
- After Ovulation
  Life of Ovo = 1 - day



Lactational Amenorrhea



(2) Barrier Methods-

In barrier methods, ovum and sperms are prevented from physically meeting with the help of barriers.

* Prevent Fertilization

- Condoms
- Fem Shield (Female Condoms)
- Cervical Cap (Reusable)
- Diaphragm(Reusable)
- Vault (Reusable)

Protect from S.T.D & AIDS

Both are Irreversible.

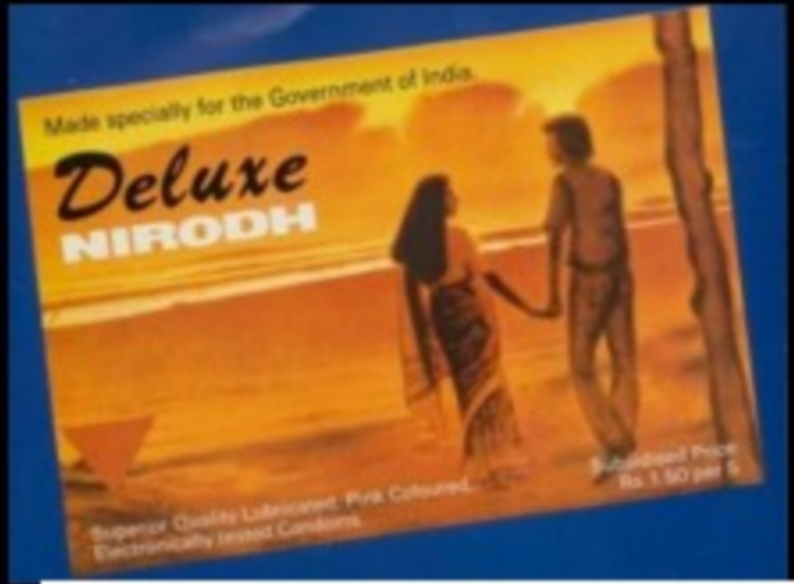
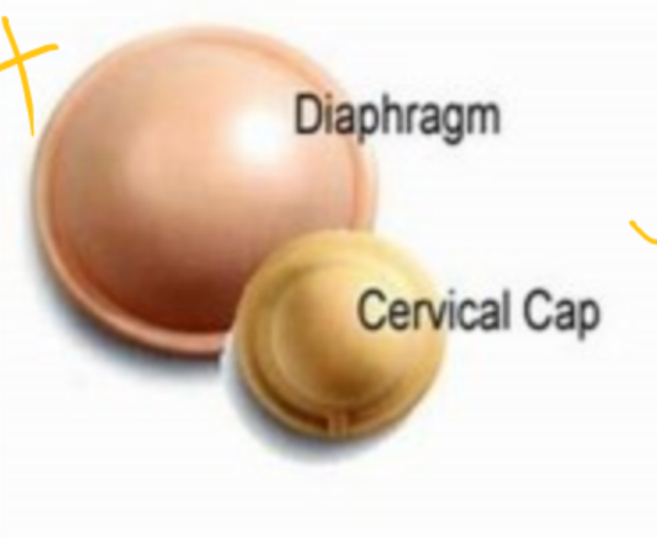




Figure 4.1(a) Condom for male



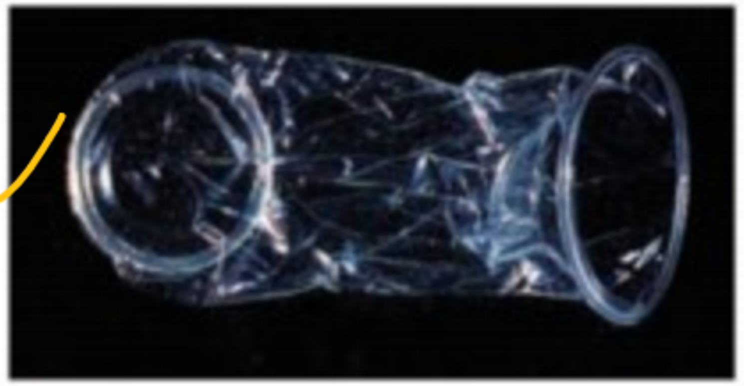
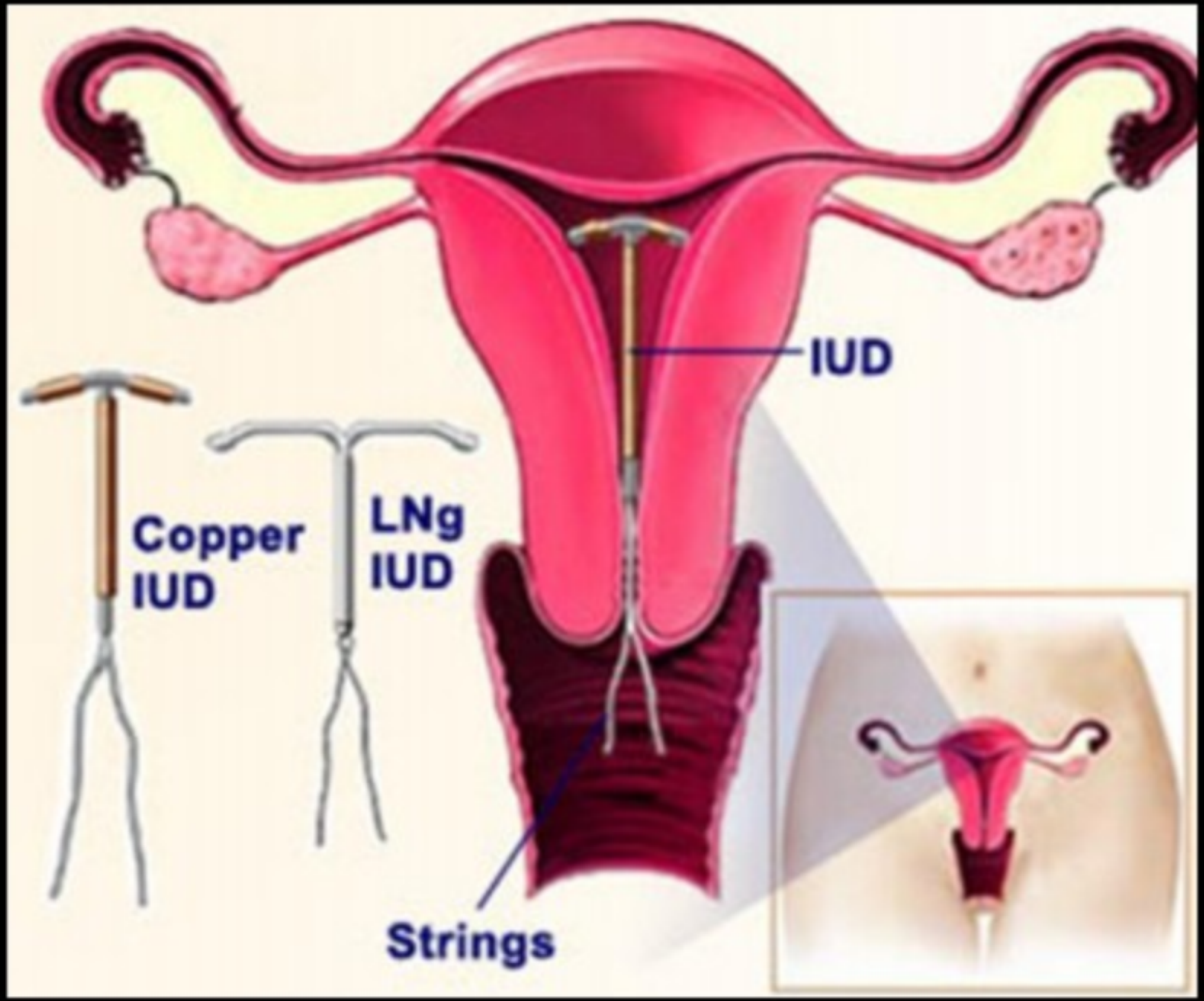


Figure 4.1(b) Condom for female

(3) Chemical Method -

(Spermicidal Agents)

- These are available in the form of creams, jellies, foams, vaginal tablets.
- These contain chemicals like citric acid, boric acid and zinc sulphate etc.
- It kill the sperm by disrupting the membrane.



Intra Uterine Devices (IUDs)

THANK YOU !!

MANTHAN NEET

REPRODUCTIVE HEALTH

LECTURE - 3

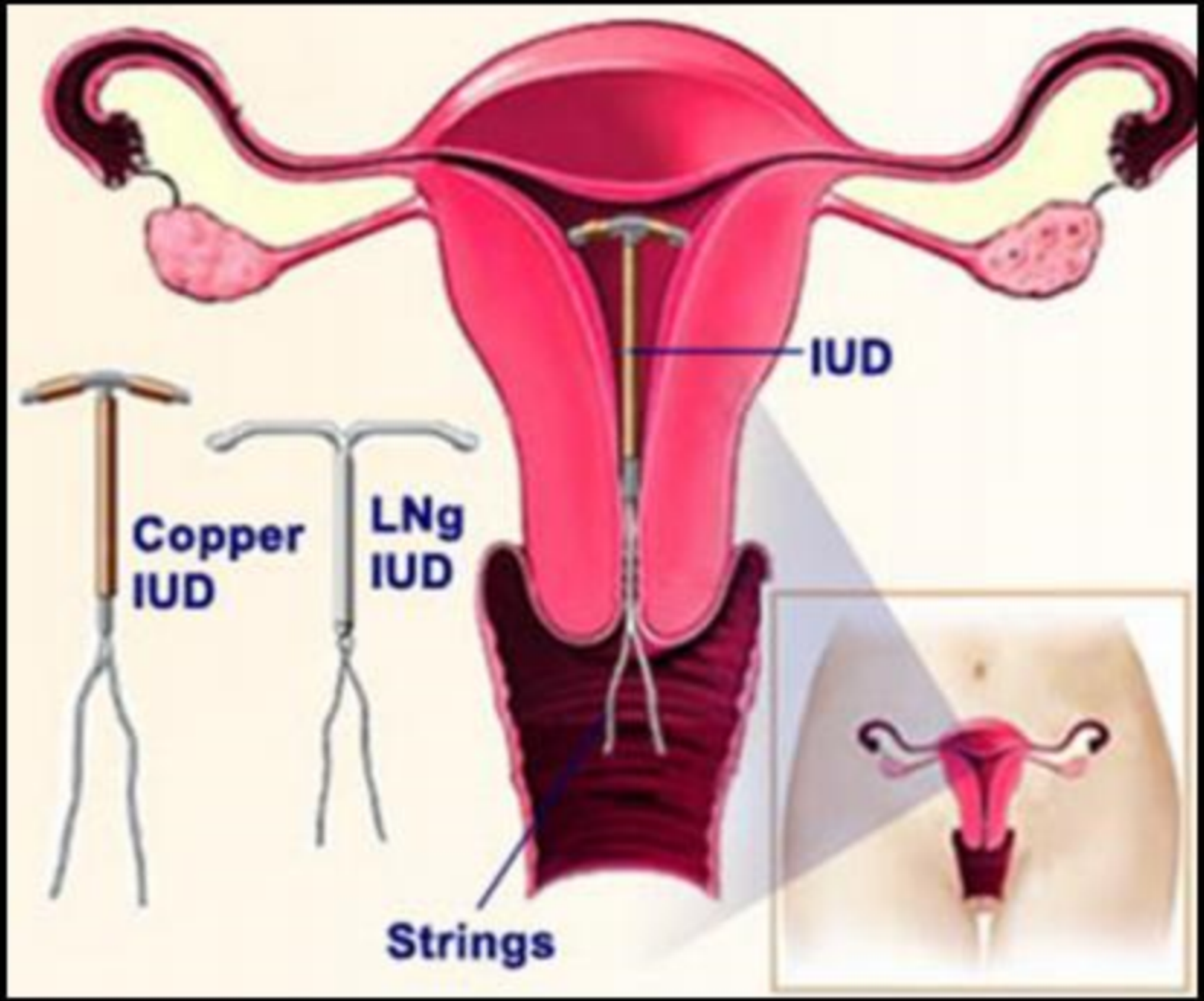
ZOOLOGY



MD SIR

TODAY'S GOAL

- Contraception methods



Intra Uterine Devices (IUDs)

IUDs

- These devices are inserted by doctors or expert nurses in the uterus through vagina.
- IUDs increase phagocytosis of sperms within the uterus and the Cu ions released suppress sperm motility and the fertilizing capacity of sperms.
- IUDs are ideal contraceptives for the females who want to delay pregnancy and/or space children.
- It is one of most widely accepted methods of contraception in India.

Types of Intra Uterine Devices-

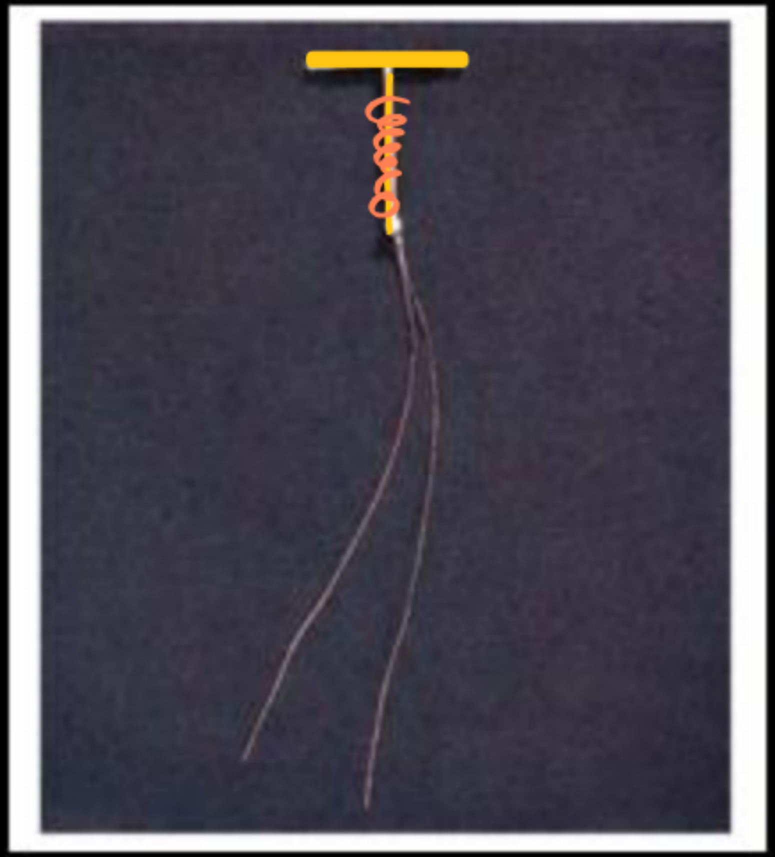
1. Non-medicated IUDs (e.g., Lippe's loop)
2. Copper releasing IUDs (CuT, Cu7, Multiload 375)
3. Hormone releasing IUDs (Progestasert, LNG-20)

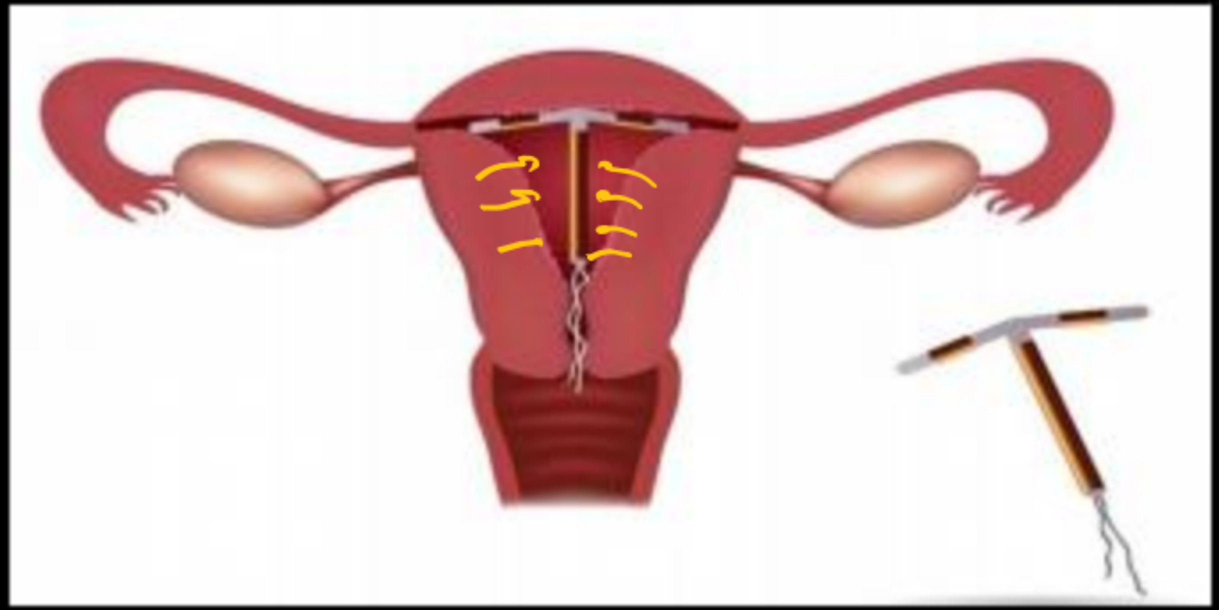


Copper releasing IUDs

- Copper IUDs commonly called Copper-Ts have ionised copper which slowly diffuses at the rate of some 50 ug/day.
- It has a local antifertility effect by bringing about release of toxic cytokines. They suppress sperm motility and their ability to fertilize the ovum.

e.g., Cu T 200, Multiload Cu T 250, Multiload Cu T 375, Cu T 380, Cu 7.



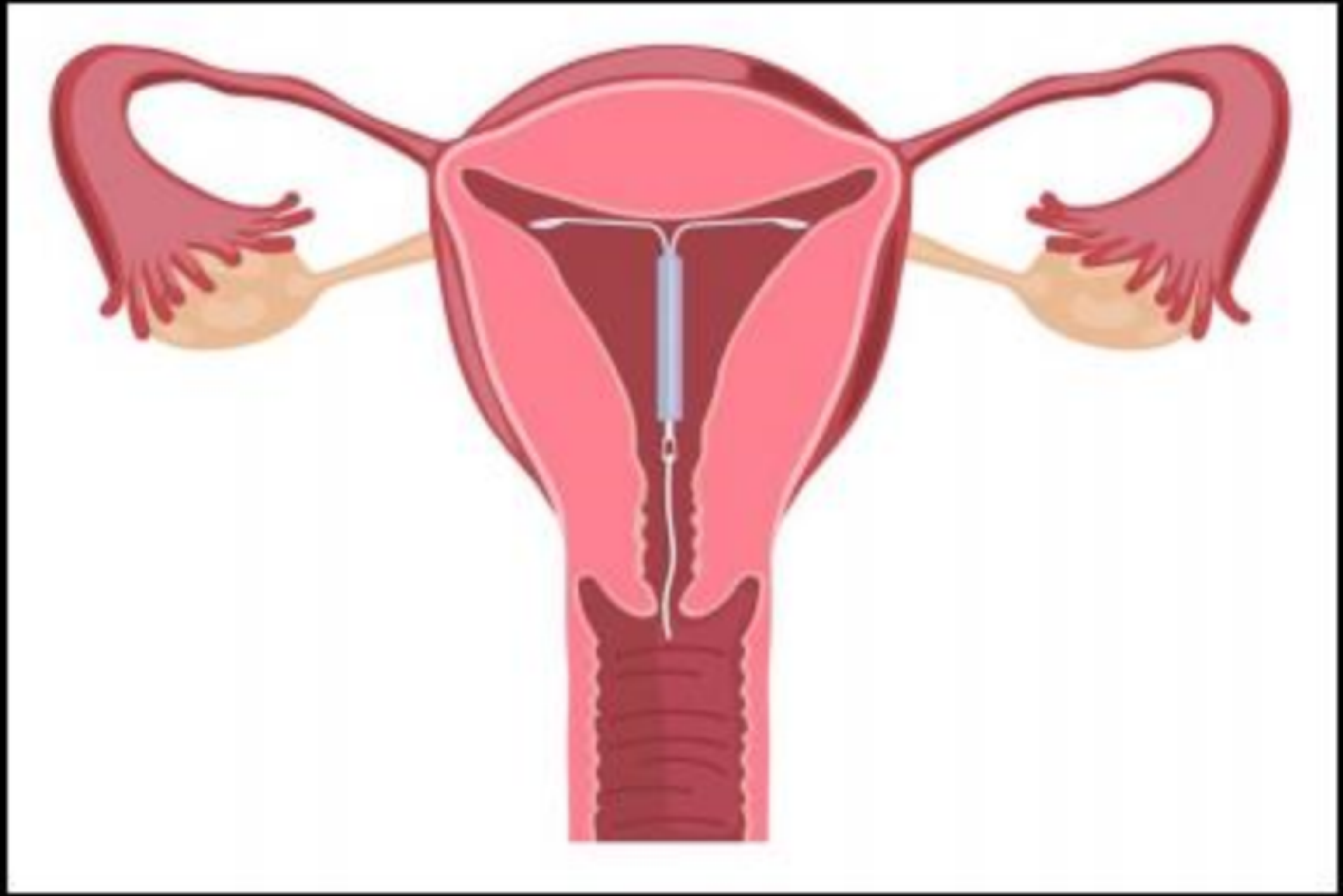


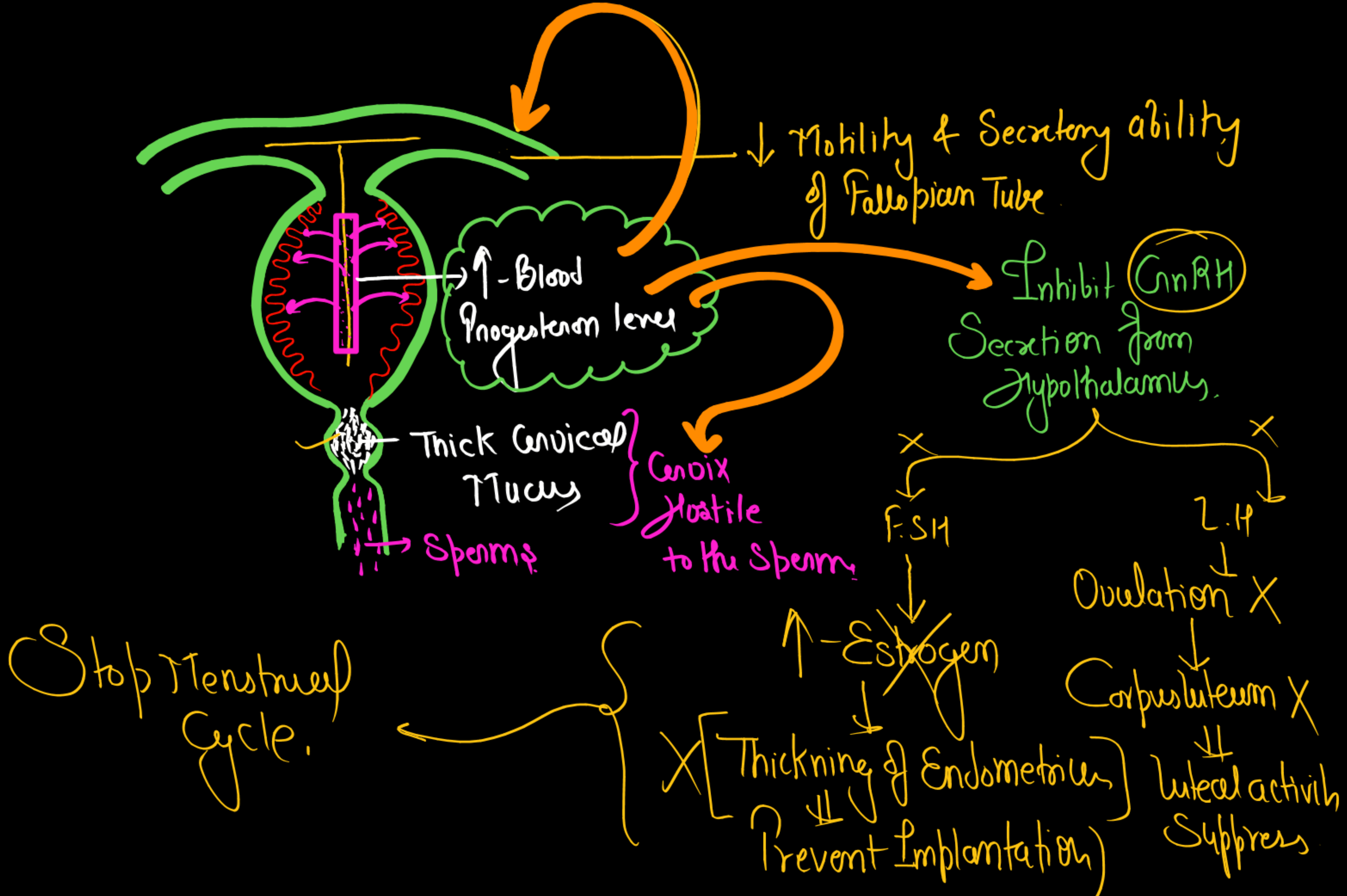
Hormone releasing IUDs

Hormone releasing IUDs include progesterone IUD (e.g., Progestasert) and levonorgestrel IUD (e.g.,LNG-20).

These make the uterus unsuitable for -

- Implantation
- Changes in cervical mucus (cervix hostile to the sperms).
- Anovulation
- Insufficient luteal activity.





↓ Motility & Secretory ability of Fallopian Tube
↑ - Blood Progesteron level
Inhibit GnRH Secretion from Hypothalamus.
Thick Cervical Mucus
Cervix Hostile to the Sperm.
Sperms
F.S.H
L.H
Ovulation X
Corpus luteum X
luteal activity Suppress
↑ - Estrogen
X [Thickning of Endometrium]
Prevent Implantation
Stop Menstrual Cycle.

Oral Contraceptive Pills(OCPs)



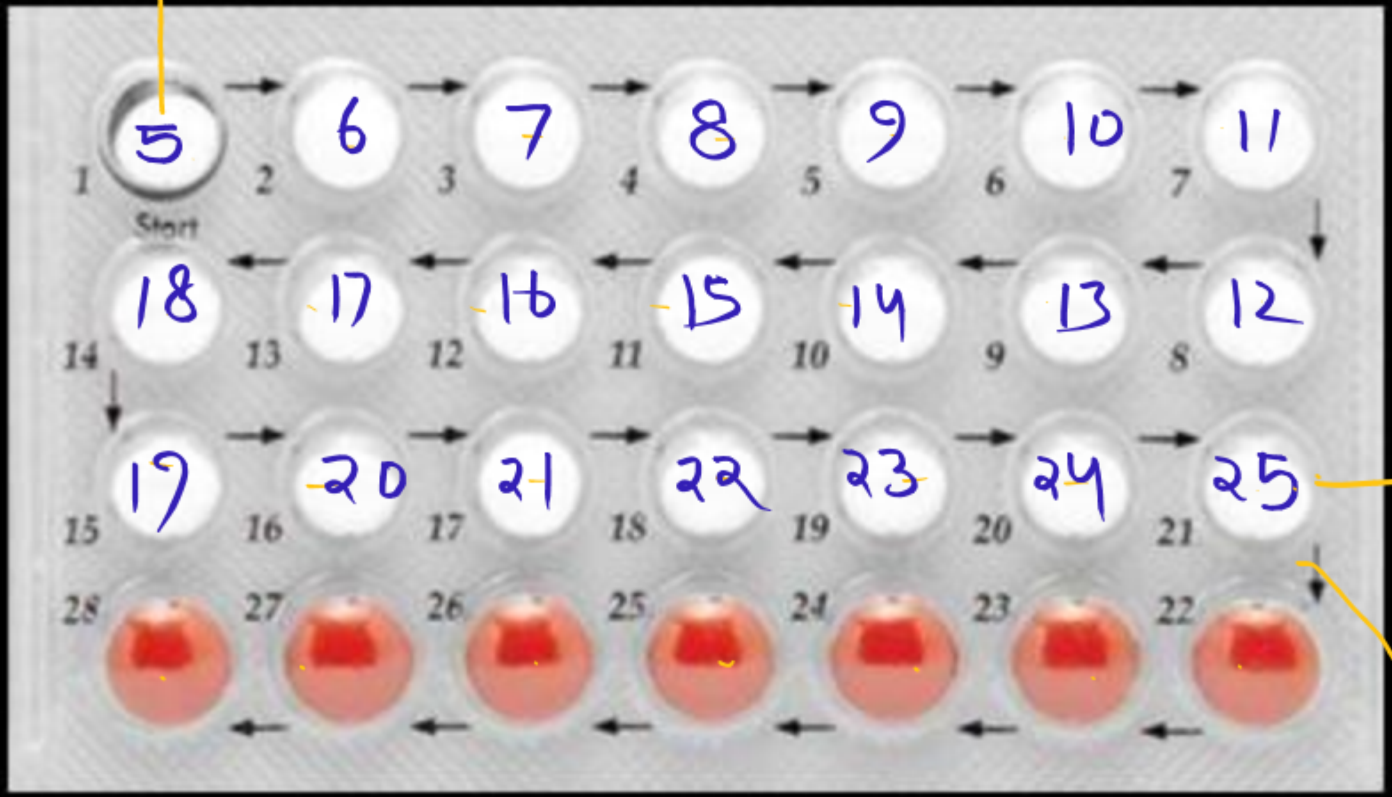
(1) Oral Contraceptive Pills(OCPs)

- They are preparation containing either progestogens or progestogen - estrogen combinations.
- They are synthetic products. The most commonly used progestin is levonorgestrel and most common oestrogen is ethinyl oestradiol.

- Mini pills = only Progesteron
- Combined pills = Progesteron + Estrogen

The pills are taken orally for 21 days in a menstrual cycle starting from 5th day and ending on 25th day. However, it is advisable to restart the course after a gap of 7 days.

Progesteron + Estrogen } Start from 5th Day of Menstrual Cycle.



25th day of Menstrual cycle

Start Menstrual flow
↓
Breakdown of Endometrium

Iron Pills, (7)

Hormonal pills act by four ways

- Inhibition of ovulation.
- Alteration in uterine endometrium to make it unsuitable for implantation.
- Changes in cervical mucus impairing its ability to allow passage and transport of sperms.
- Inhibition of motility and secretory activity of fallopian tubes

(2) Injectables (DEPO-PROVERA) -



- Progestogens alone or in combination with estrogen can also be used by females as injections.
- They are depot-medroxy progesterone acetate (DEMPA) effective for three month.

(3) Implants -

- These are progrstin containing devices which are implanted sub dermally for providing long term contraception (3-5 years).
- Norplant is progestin only containing devise has six small silicone (permeable) capsules containing levonorgesterol and these are inserted under skin of left upper arm (5 years).




1
2
3
4
5
6

(4) Emergency Contraception-

- Administration of progestogens or progestogen-estrogen combinations or IUDs within 72 hours of coitus have been found to be very effective as emergency contraceptives (morning after pills) as they could be used to avoid possible pregnancy due to rape or casual unprotected intercourse.
- Mifepristone (RU486) (antiprogrsterone) is a single pill treatment. It has very high affinity for progesterone receptors.

Side effects of Contraceptive Methods

Their possible side-effects are

- Nausea
- Abdominal pain
- Breakthrough bleeding
- Irregular menstrual bleeding
- Breast cancer

(B) Permanent Methods/ Stérilisation Techniques/ Terminal Methods

- Surgical intervention blocks gamete transport and thereby prevent conception.
- These techniques are highly effective but their reversibility is very poor

(1) Vasectomy

- It is a permanent method of contraception for males.
- Both vas deferens are ligated and cut.
- It is a minor surgical procedure and done free of cost at government hospitals
- Sperm production continues after vasectomy but ejaculated semen is without sperms.
- It is not effective immediately.

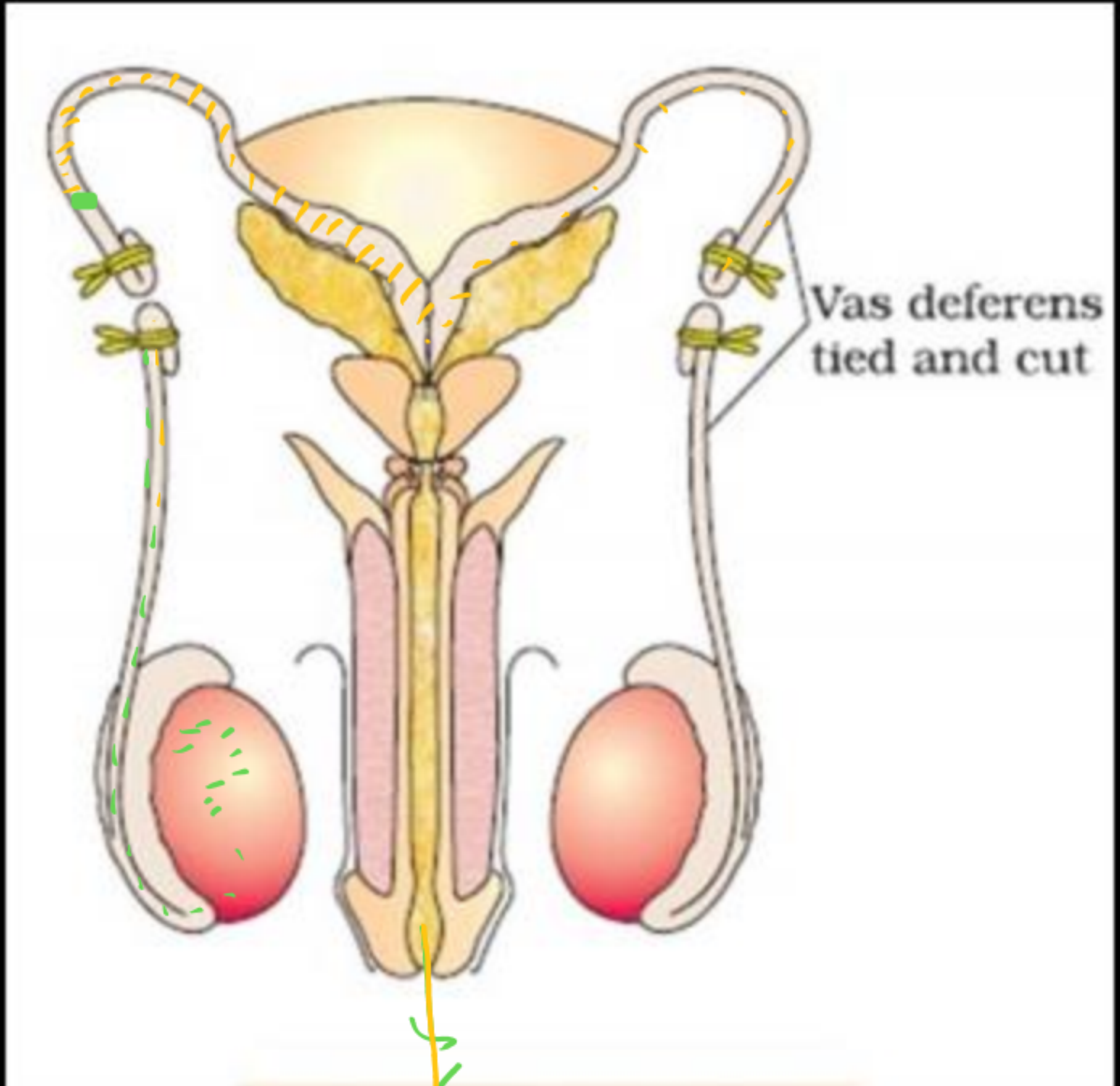


Figure 4.4a Vasectomy

Semen without Sperm



(2) Tubectomy

- It is a permanent method of contraception for females.
- A small part of fallopian tubes is removed or tied up through a small incision in the abdomen (laparotomy) or through vagina.
- It is effective immediately.
- Menstrual cycle continues after tubectomy.
- The released oocyte is destroyed by phagocytes.

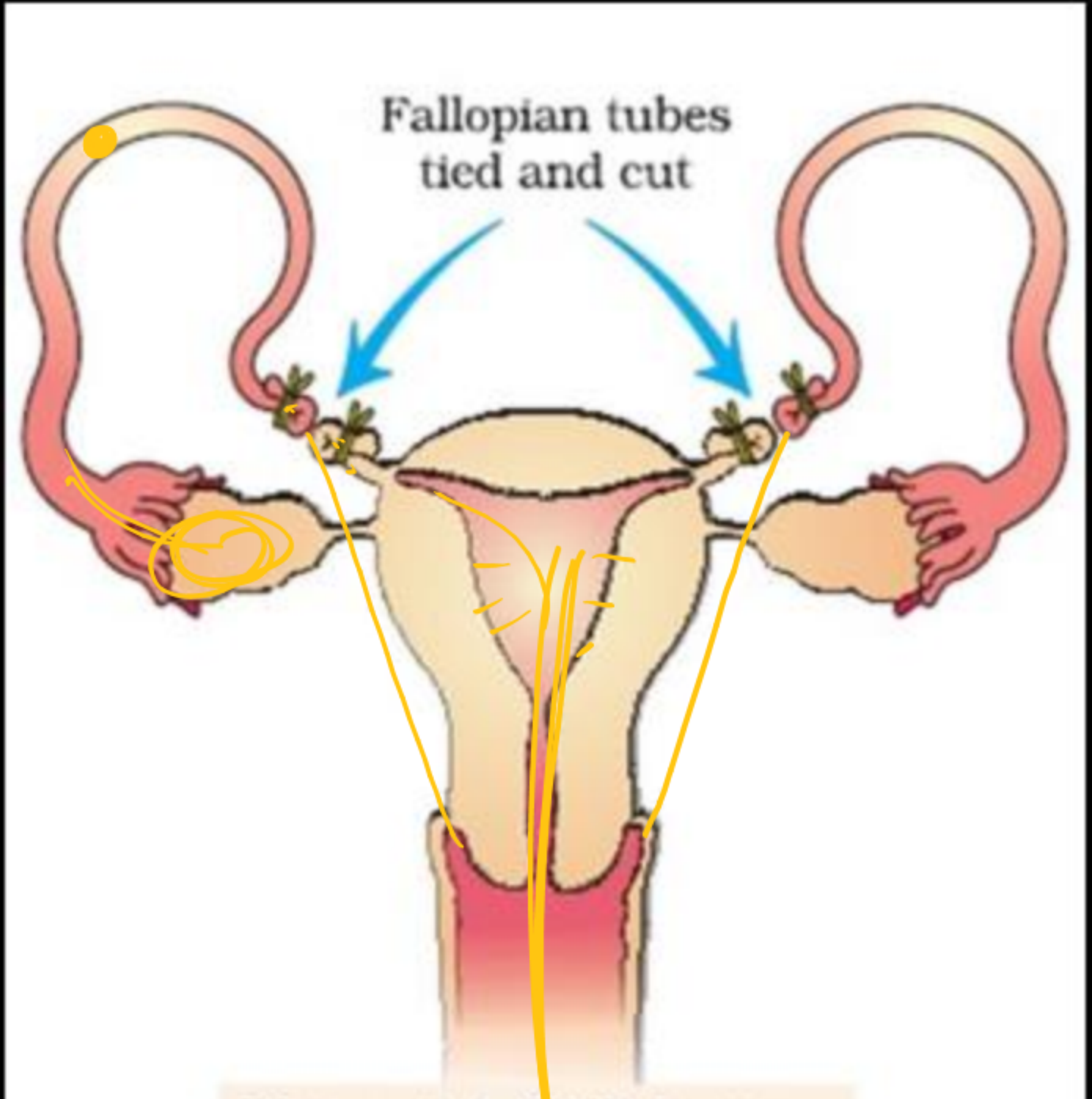


Figure 4.4 (b) Tubectomy

THANK YOU !!

MANTHAN NEET

REPRODUCTIVE HEALTH

LECTURE - 4

ZOOLOGY



MD SIR

TODAY'S GOAL

- MTP
- STD
- Infertility

MEDICAL TERMINATION OF PREGNANCY (MTP)

- Intentional or voluntary termination of pregnancy before full term is called medical termination of pregnancy (MTP) or induced abortion.
- Nearly **45 to 50 million MTPs** are **performed in a year all over the world which accounts to 1/5th of the total number of conceived pregnancies in a year.**
- Government of India **legalised MTP in 1971** with some strict conditions to avoid its misuse.
- MTPs are considered relatively **safe during the first trimester, i.e., upto 12 weeks of pregnancy**. Second trimester abortions are much more riskier.

The Medical Termination of Pregnancy (Amendment) Act, 2017 was enacted by the government of India with the intension of reducing the incidence of illegal abortion and consequent maternal mortality and morbidity.

According to this Act, a pregnancy may be terminated on certain considered grounds within the first 12 weeks of pregnancy on the opinion of one registered medical practitioner. If the pregnancy has lasted more than 12 weeks, but fewer than 24 weeks, two registered medical practitioners must be of the opinion, formed in good faith, that the required ground exist.

The grounds for such termination of pregnancies are:

(i) The continuation of the pregnancy would involve a risk to the life of the pregnant woman or of grave injury physical or mental health; or

(ii There is a substantial risk that of the child were born, it would suffer from such physical or mental abnormalities as to be seriously handicapped.

Sexually Transmitted Diseases (STDs) or STI

- Infections which are transmitted through sexual intercourse are collectively called sexually transmitted infections (STI) or pelvic inflammatory diseases (PID) or venereal diseases (VD) or reproductive tract infections (RTI).
- Their incidences are reported to be very high among persons in the age group of 15-24 years.

Early symptoms –

- Itching
- Fluid discharge,
- Slight pain
- Inflammation (swelling) etc.

Complications of Pelvic Inflammatory Diseases (PID)-

- Abortions
- Stillbirths
- Ectopic Pregnancies
- Infertility
- Cancer of the reproductive tract

You could be free of these infections by following the simple principles given below:

(i) Avoid sex with unknown partners/multiple partners.
(ii) Always try to use condoms during coitus.
(iii) In case of doubt, one should go to a qualified doctor for early detection and get complete treatment if diagnosed with infection.

Sexually Transmitted Diseases (STDs)

1. Chlamydiasis (B)- *Chlamydia trachomatis*
2. Gonorrhoea (B)- *Neisseria gonorrhoeae.*
3. Syphilis (B)- *Treponema pallidum*
4. Chancroid (B)- *Haemophilus ducrei*

(Type-I = Oral herpes)

5. Genital herpes (V) - *Type II herpes simplex virus (HSV-2)*
6. Genital warts (V)-*Human Papilloma Virus (HPV)* → Cervical & Vaginal Cancer
7. Hepatitis-B (V) - HBV
8. AIDS (V) - *Human Immunodeficiency Virus (HIV).*

9. Trichomoniasis (P) – *Trichomonas vaginalis*.

Yellow, Green Discharge.

vvv Imp.

Note - Except for hepatitis-B, genital herpes and HIV infections, other diseases are completely curable if detected early and treated properly.

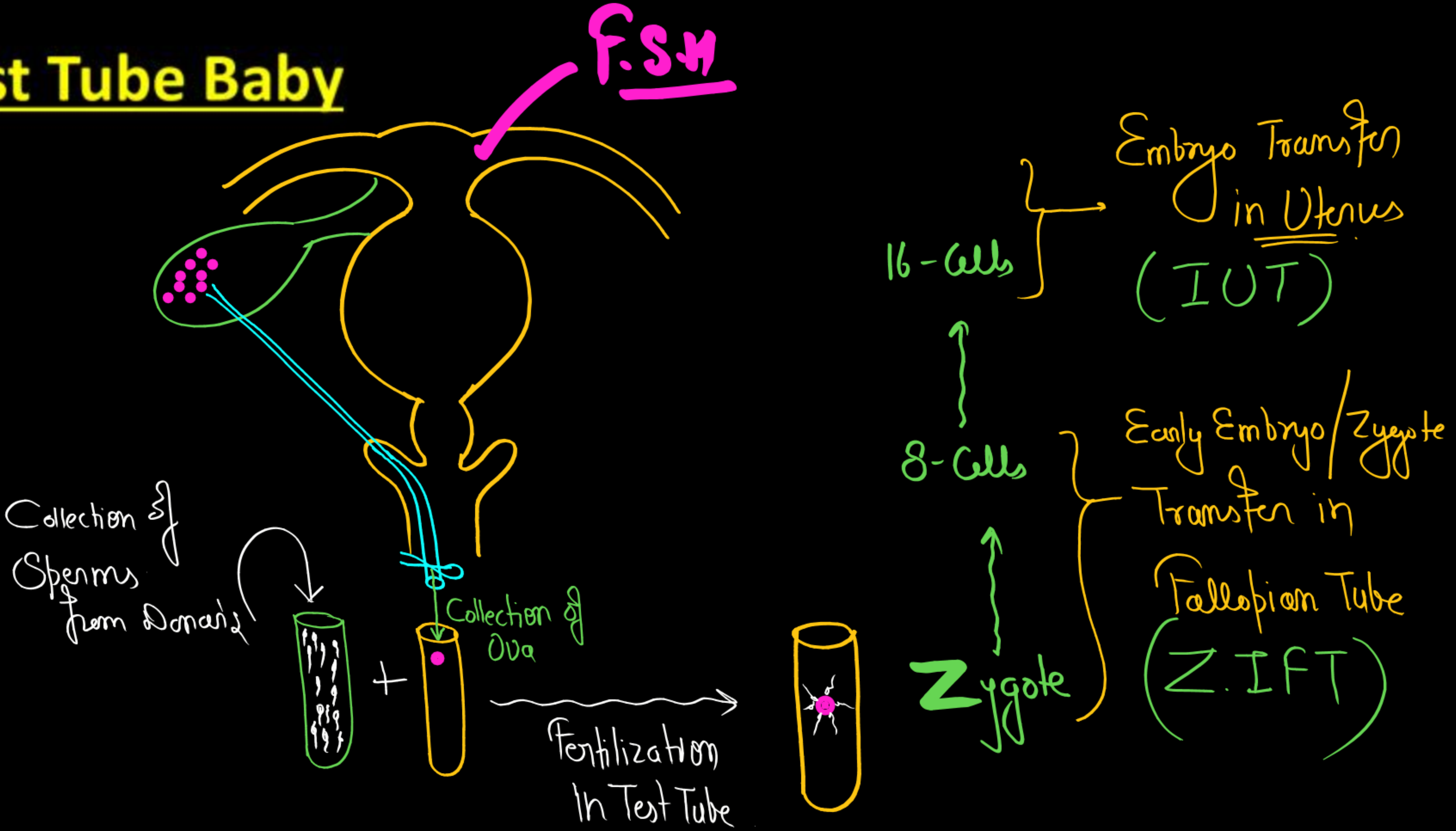
Infertility –

- Inability to conceive or produce children even after 2 years of unprotected sexual cohabitation is called infertility.
- A large number of couples all over the world including India are infertile.

Assisted reproductive technologies (ART)

However, where such corrections are not possible, the couples could be assisted to have children through certain special techniques commonly known as assisted reproductive technologies (ART).

Test Tube Baby



ART

[In Vitro Fertilization]
[Fertilization in Test tube / outside the body]

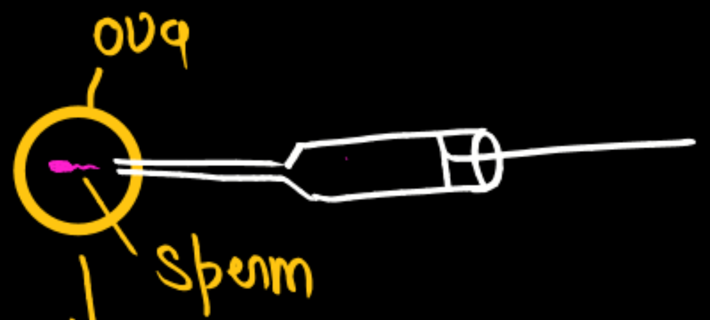
↓

Embryo Transfer [E.T.]

- Test Tube baby
  - Zygote Intra Fallopian Transfer (Z.I.F.T)
  - Intra Uterine Transfer (IUT)
- Intra-Cytoplasmic Sperm Injection } I.C.S.I.

[In Vivo Fertilization]
[Fertilization inside the body]

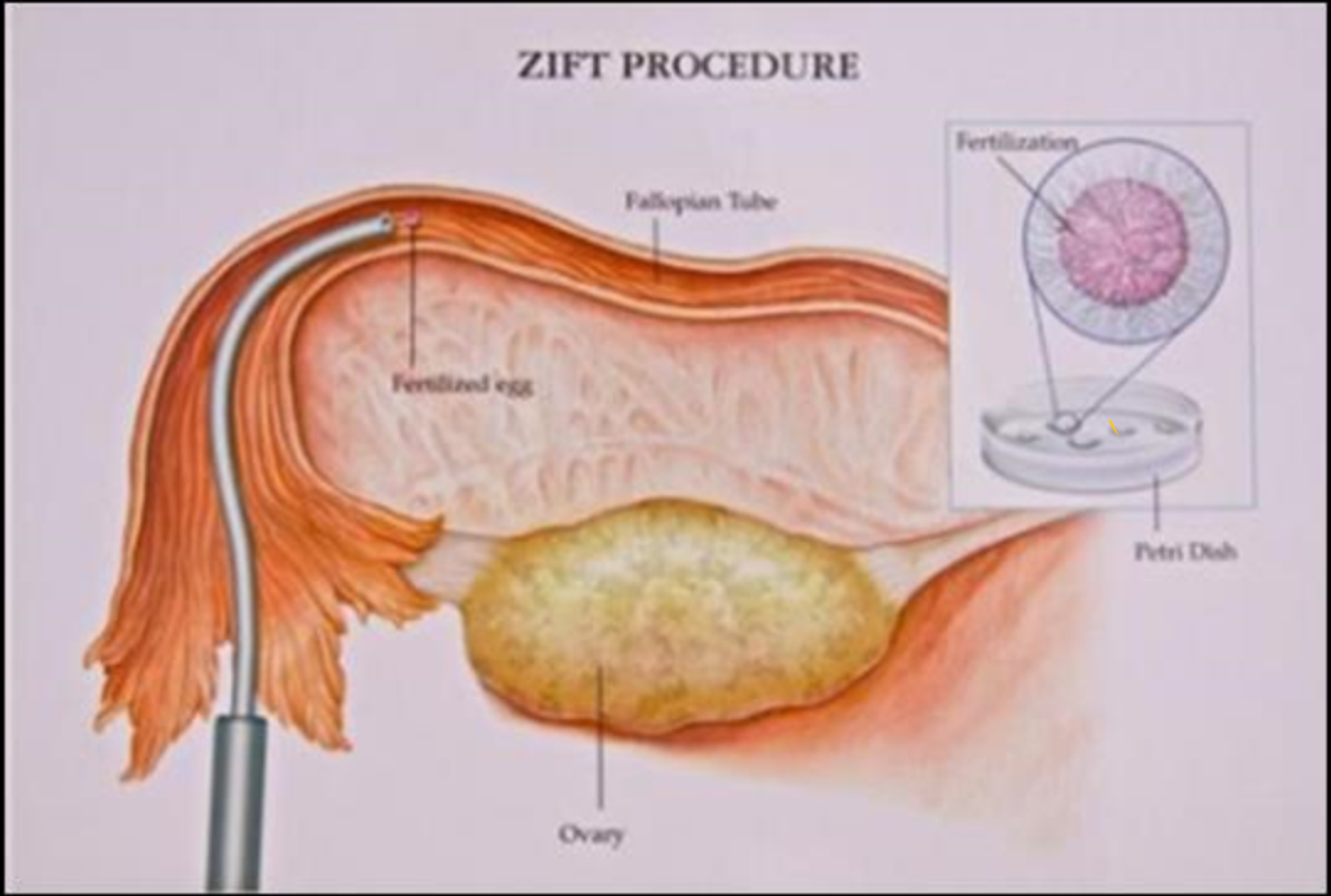
↓



↓

Zygote in Test tube → (I.U.T)

***In vitro* fertilisation** (IVF–fertilisation outside the body in almost similar conditions as that in the body) followed by **embryo transfer** (ET) is one of such methods. In this method, popularly known as **test tube baby** programme, ova from the wife/donor (female) and sperms from the husband/donor (male) are collected and are induced to form zygote under simulated conditions in the laboratory. The zygote or early embryos (with upto 8 blastomeres) could then be transferred into the fallopian tube (ZIFT–**zygote intra fallopian transfer**) and embryos with more than 8 blastomeres, into the uterus (IUT – **intra uterine transfer**), to complete its further development. Embryos formed by **in-vivo fertilisation** (fusion of gametes within the female) also could be used for such transfer to assist those females who cannot conceive.


ZIFT PROCEDURE
Fertilization
Fallopian Tube
Fertilized egg
Petri Dish
Ovary

[In Vivo Fertilization]

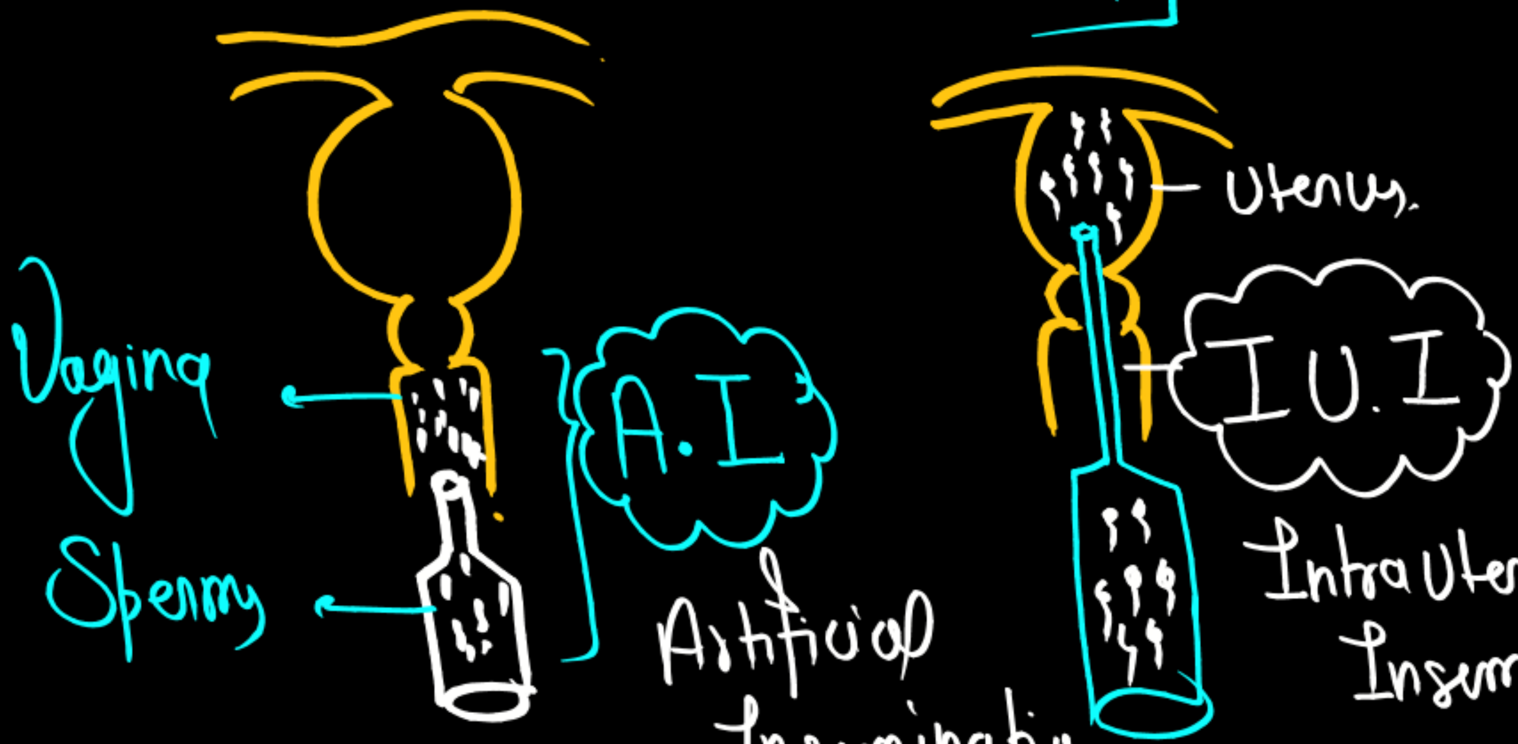
↓

(Fertilization in side the body)

↓

[Gamete Transfer]

[Male Gamete Transfer]



Artificial Insemination

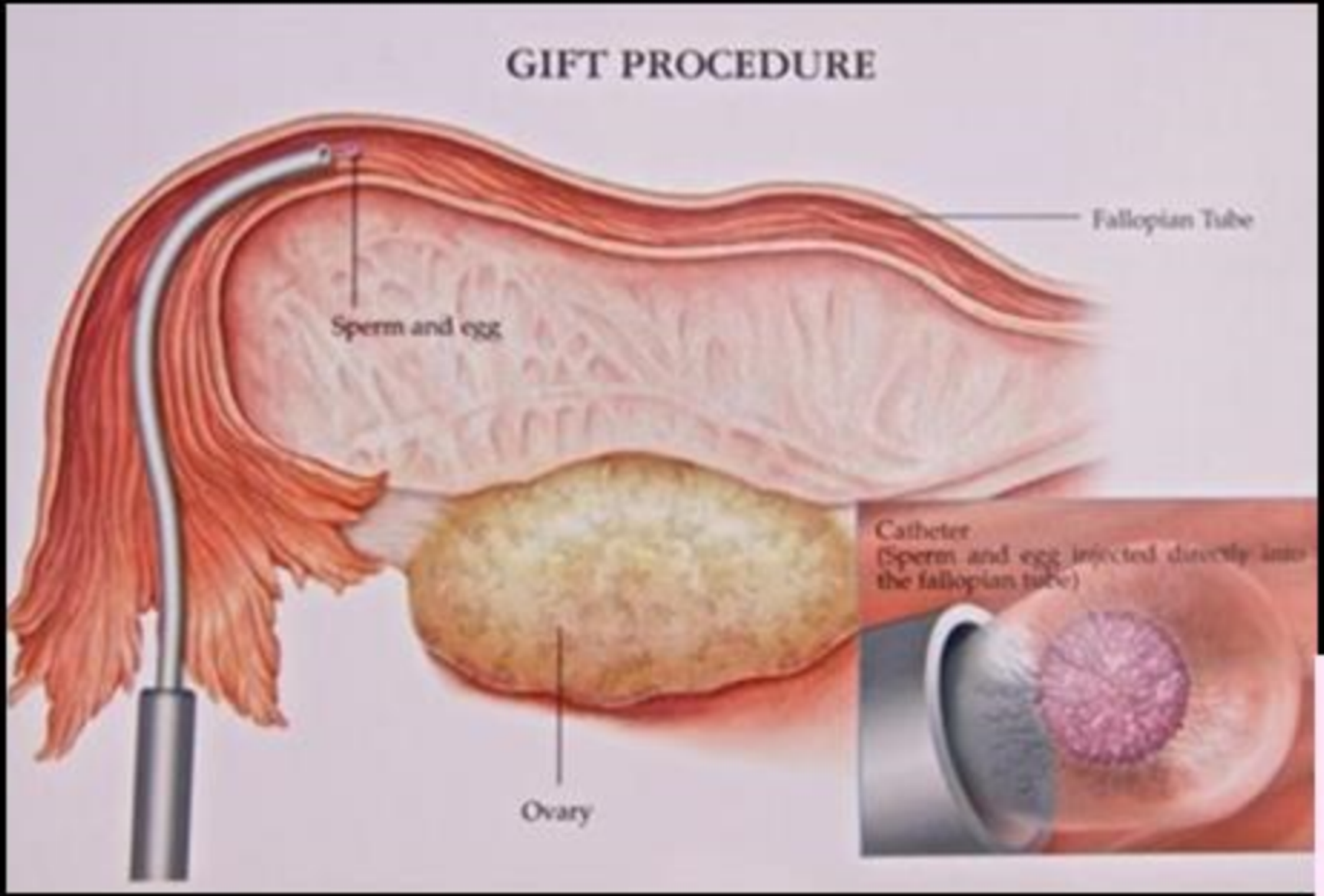
Intra Uterine Insemination

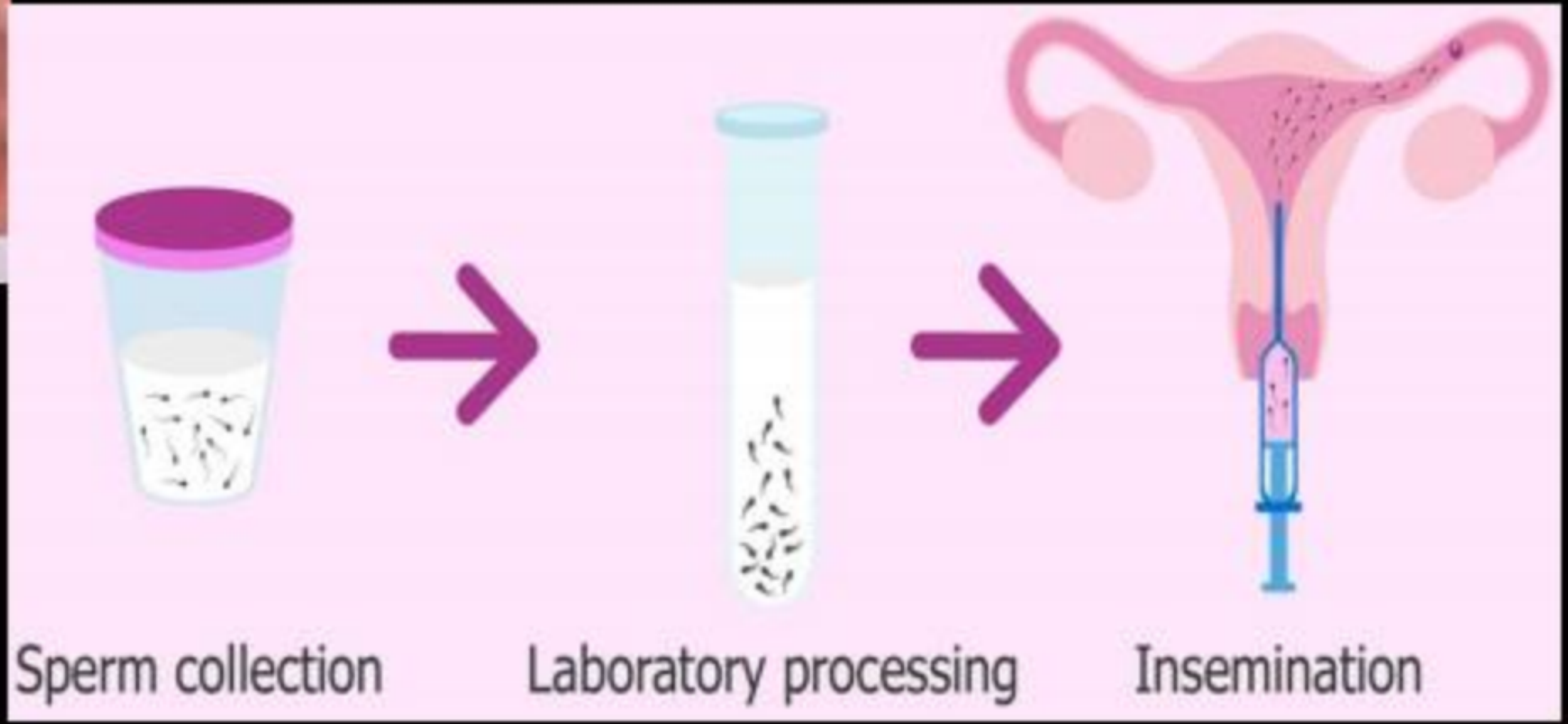
[Female Gamete Transfer]

↓

[G.I.F.T] = Gamete [ova] Intra fallopian Transfer

Transfer of an ovum collected from a donor into the fallopian tube (GIFT – **gamete intra fallopian transfer**) of another female who cannot produce one, but can provide suitable environment for fertilisation and further development is another method attempted. **Intra cytoplasmic sperm injection** (ICSI) is another specialised procedure to form an embryo in the laboratory in which a sperm is directly injected into the ovum. Infertility cases either due to inability of the male partner to inseminate the female or due to very low sperm counts in the ejaculates, could be corrected by **artificial insemination** (AI) technique. In this technique, the semen collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus (IUI – **intra-uterine insemination**) of the female.


GIFT PROCEDURE
Fallopian Tube
Sperm and egg
Catheter
(Sperm and egg injected directly into the fallopian tube)
Ovary


Sperm collection
Laboratory processing
Insemination

Which of the following is the causative agent of syphilis?

1. Trypanosoma
2. Human Papilloma virus
3. Treponema
4. Haemophilus ducrei

Which of the following is a venereal disease, caused by a virus and can get transmitted by blood contact also?

1. Gonorrhoea
2. Syphilis
3. Trichomoniasis
4. Hepatitis-B

Among the following contraceptive methods, maximum failure rate is of

(1) Barrier methods

(2) Rhythm method

(3) OCPs

(4) IUDs

Which of the following is **correct** match w.r.t. items mentained against their category and with one exception in it?

	Items	Category	Exception
(1)	CuT, Cu7, Multiload 375	Cu containing IUD	Multiload 375
(2)	Diaphragms Cervical caps, vaults	Barrier method of contraception	Vaults
(3)	IUD, iPill, Gossypol	Emergency contraception	Gossypol
(4)	Mala D Saheli, Mala L	Oral contraceptives	Saheli

The technique called gamete intrafallopian transfer (GIFT) is recommended for those females

(1) Whore cervical canal is too narrow to allow passage for the sperms

(2) Who cannot provide suitable environment for fertilisation

(3) Who cannot produce an ovum

(4) Who cannot retain the foetus inside uterus

The Test-tube Baby Programme employs which one of the following techniques?

(1) Gamete intra fallopian transfer (GIFT)

(2) Zygote intra fallopian transfer (ZIFT)

(3) Intra cytoplasmic sperm injection (ICSI)

(4) Intra uterine insemination (IUI)

The latest technique to produce a child is **GIFT**. The full form is

(1) Gametic internal fertilization and transfer

(2) Gametic intra fallopian transfer

(3) Gametic inter fallopian transfer

(4) General internal fallopian transfer

If a person is suffering from severe male infertility due to very few sperms (oligozoospermia) or even no live sperms (azoospermia) in the ejaculate, it can be overcome by ________. This should offer couples an alternative to using donor sperm

(1) GIFT

(2) ZIFT

(3) ICSI

(4) IVF

The stage transferred into the uterus after induced fertilization of ova in the laboratory is

(1) Zygote

(2) Embryo at 4 blastomere stage

(3) Embryo at 2 blastomere stage

(4) Morula

Test tube baby is the one

(1) Who is reared on artificial medium outside the womb

(2) Growth of human baby inside the fallopian tube instead of uterus

(3) Ova from wife/donor (female) and sperms from husband/donor (male) are induced to form zygote by IVF and then implanted in female

(4) Baby born after artificial insemination

All the following statements about ZIFT are correct, but one is wrong. Which one is wrong?

(1) It is zygote intra fallopian transfer

(2) Zygote is transferred into the fallopian tube after IVF

(3) Early embryos upto 8 blastomeres can also be transferred into the fallopian tubes

(4) Embryos with more than 8 blastomeres are also transferred into the fallopian tubes

In which of the following ARTs, embryos more than eight blastomeres are transferred into uterus?

(1) IUI

(2) ZIFT

(3) IUT

(4) ICSI

. To avoid transmission of STDs we would :

(i) Avoid sex with multiple partners

(ii) Always have unprotected sex

(iii) Use condom during coitus

(iv) Avoid sex with unknown partners

(v) Avoid sharing of needles

(vi) In case of doubt, go to a qualified doctor for early detection and get complete treatment if diagnosed with disease.

(1) (i), (ii), (iii), (iv), (v) (2) (i), (iii), (iv), (v), (vi)

(3) (i), (ii), (iii), (vi) (4) (i), (ii), (iv)

THANK YOU !!

MANTHAN NEET

HUMAN HEALTH AND DISEASES

LECTURE - 1

ZOOLOGY



MD SIR

TODAY'S GOAL

- IMMUNITY

IMMUNITY

This overall ability of the host to fight the disease-causing organisms, conferred by the immune system is called immunity. Immunity is of two types:

(i) Innate immunity

(ii) Acquired immunity.

Immunity

[Innate Immunity] = By Birth
[Non-Specific]

[I^st Line of Defence]
[External]

1) - Physical Barrier →
   - Protecting layer
     - → Skin
     - → Mucus Epithelium

2) - Physiological Barrier
   - → Tears
   - → Saliva
   - → Mucus
   - → HCl

[II^nd Line of Defence]
[Internal]

- → Cellular Barrier
- → Inflammation
- → Fever
- → Cytokine Barrier (vvImp)

[Acquired Immunity]
↳ Acquired after Birth

(Specific)

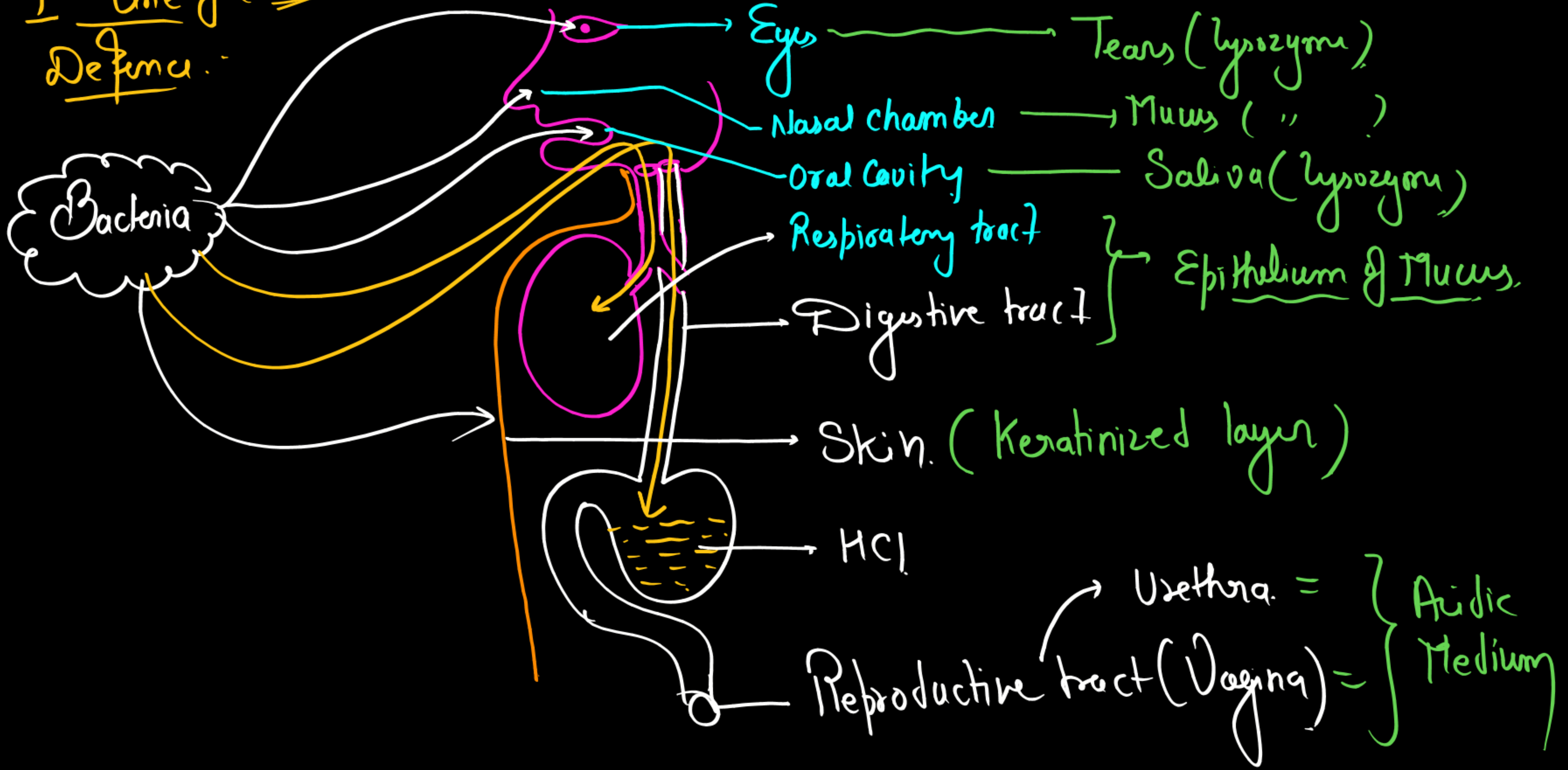
[III^rd Line of Defence]
[Internal]

(Mammory based)

↓

(B lym & T-lym based Immunity)

I^st - Line of (Non specific) Defence.

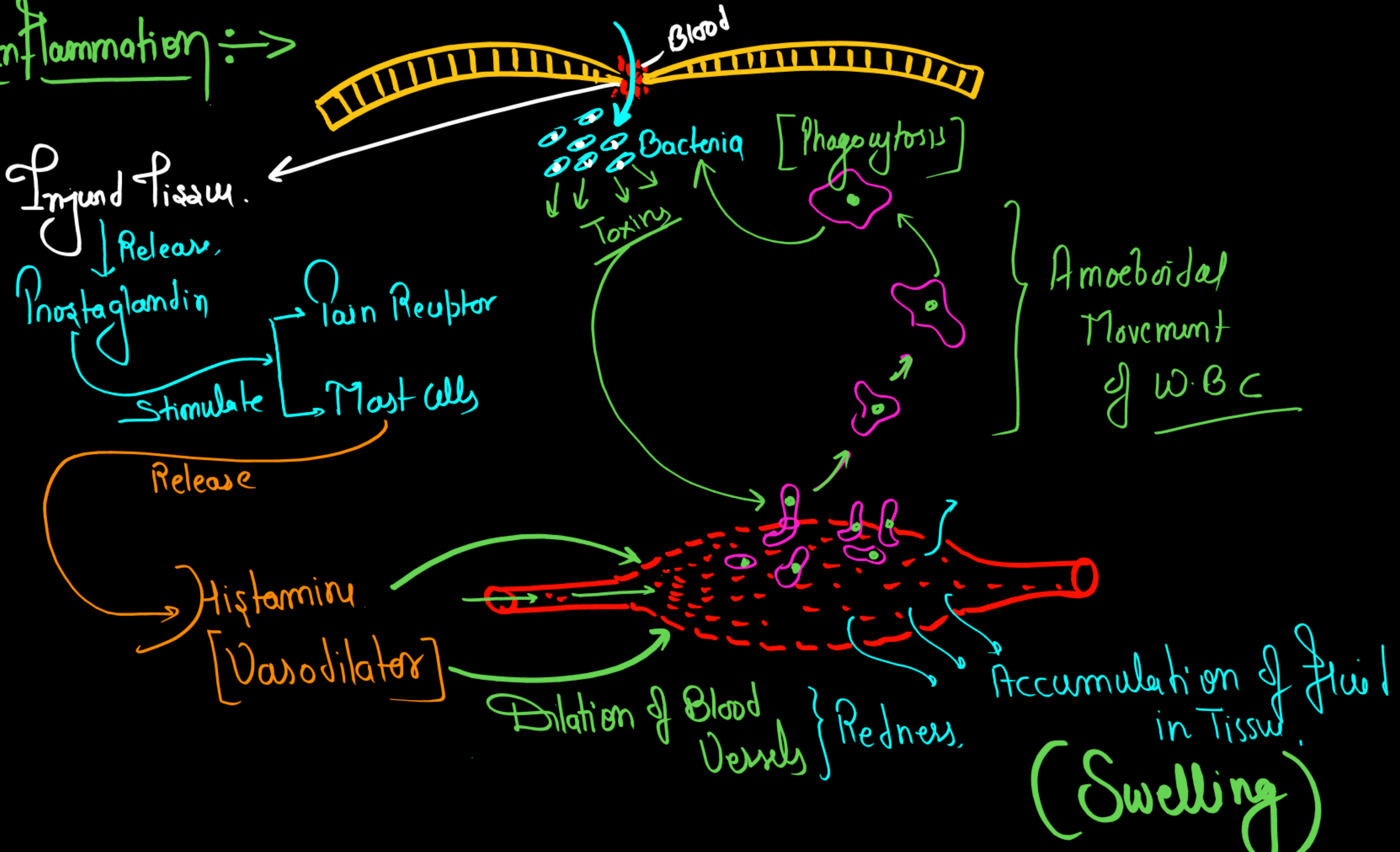


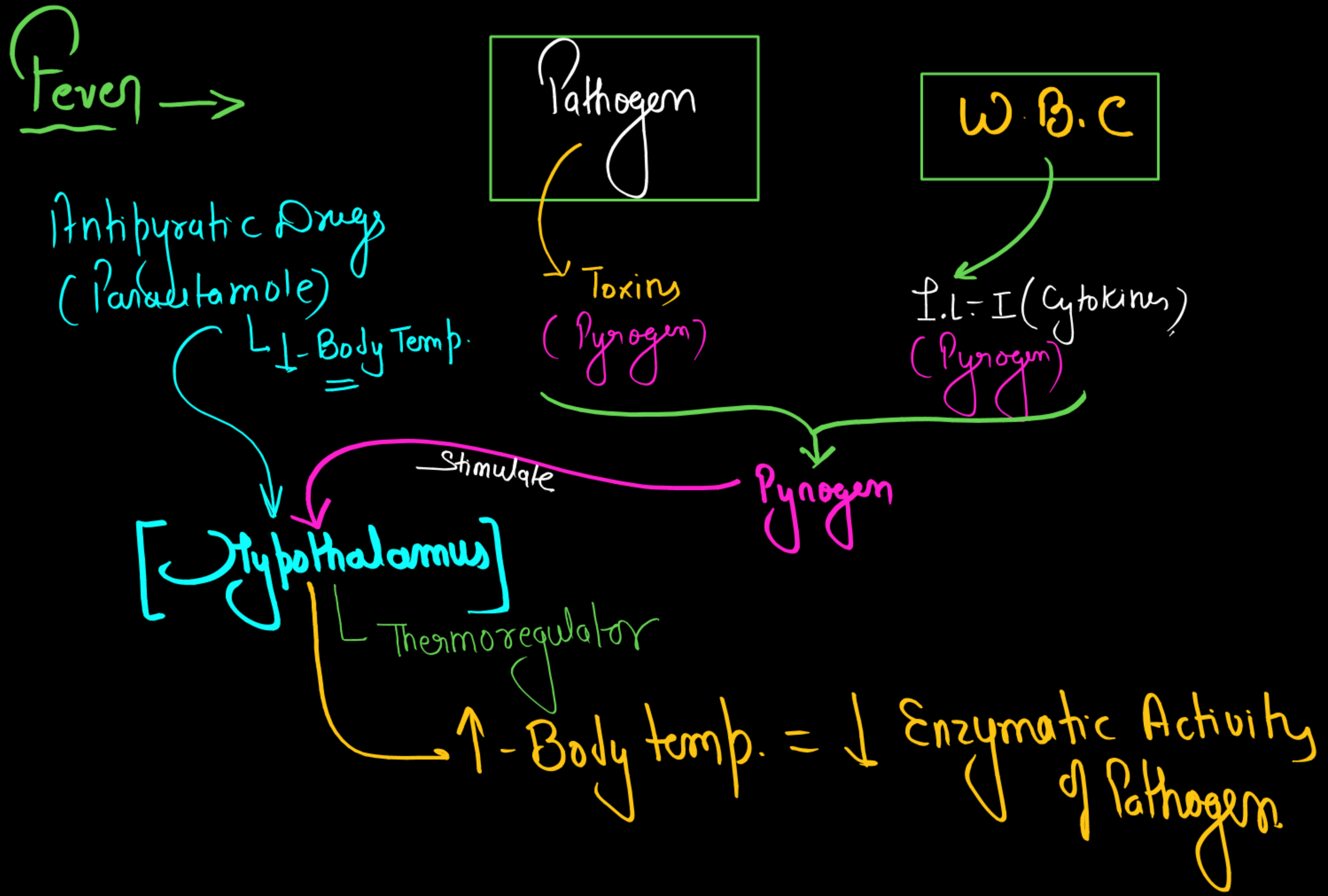
IInd line of Defence (Non-Specific-Internal)

1) - Cellular Barrier →

- [Phagocytic cells]
  - (In Blood)
    - (W.B.C.) →
      1) - Monocytes.
      2) - Neutrophylis. [P.M.N.L.]
  - [In tissue]
    - Kuffer cells → liver
    - Osteoclast → Bone
    - Chondroclast → Cartilage.
    - Microglial cells → Brain.
    - etc.
- [Nonphagocytic cells] or
  - [Natural killer cells] or N.K. cells
    - Kill → Virus Infected cells + Cancer cells

2)- Inflammation :->




Fever →
Pathogen
W.B.C
Antipyratic Drugs
(Paracetamole)
↓- Body Temp.
Toxins
(Pyrogen)
I.L-I (Cytokines)
(Pyrogen)
Stimulate
Pyrogen
[Hypothalamus]
Thermoregulator
↑- Body temp. = ↓ Enzymatic Activity of Pathogen.

Cytokines Barrier → (I.L. & I.N.F.)

vvvimp

Interferon (I.N.F.) →

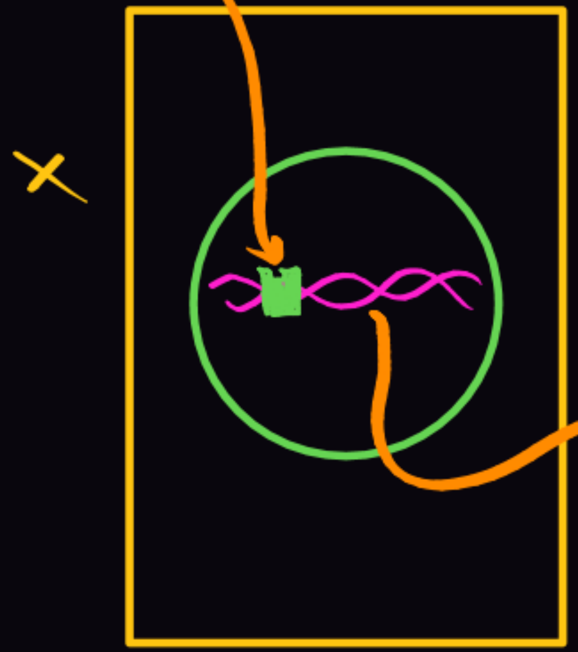


[Virus Infected Cells]

Formation of Interferon [INF]

↓

- Small Protein
- Host Specific but Not Virus Specific.
- Inhibit - Translation of Viral Protein In Non-infected cells



[Non-Viral Infecting Cells]

Formation of Anti-Viral Protein [T.I.P]

↓

which inhibit Translation of Viral Protein.

[T.I.P]

8.2 Immunity

Everyday we are exposed to large number of infectious agents. However, only a few of these exposures result in disease. Why? This is due to the fact that the body is able to defend itself from most of these foreign agents. This overall ability of the host to fight the disease-causing organisms, conferred by the immune system is called **immunity**.

Immunity is of two types: (i) Innate immunity and (ii) Acquired immunity.

8.2.1 Innate Immunity

Innate immunity is non-specific type of defence, that is present at the time of birth. This is accomplished by providing different types of barriers to the entry of the foreign agents into our body. Innate immunity consist of four types of barriers. These are —

(i) ***Physical barriers*** : Skin on our body is the main barrier which prevents entry of the micro-organisms. Mucus coating of the epithelium lining the respiratory, gastrointestinal and urogenital tracts also help in trapping microbes entering our body.

(ii) ***Physiological barriers*** : Acid in the stomach, saliva in the mouth, tears from eyes–all prevent microbial growth.

(iii) ***Cellular barriers*** : Certain types of leukocytes (WBC) of our body like polymorpho-nuclear leukocytes (PMNL-neutrophils) and

(iv) ***Cytokine barriers*** **:** Virus-infected cells secrete proteins called **interferons** which protect non-infected cells from further viral infection.

THANK YOU !!

MANTHAN NEET

HUMAN HEALTH AND DISEASES

LECTURE - 2

ZOOLOGY



MD SIR

TODAY'S GOAL

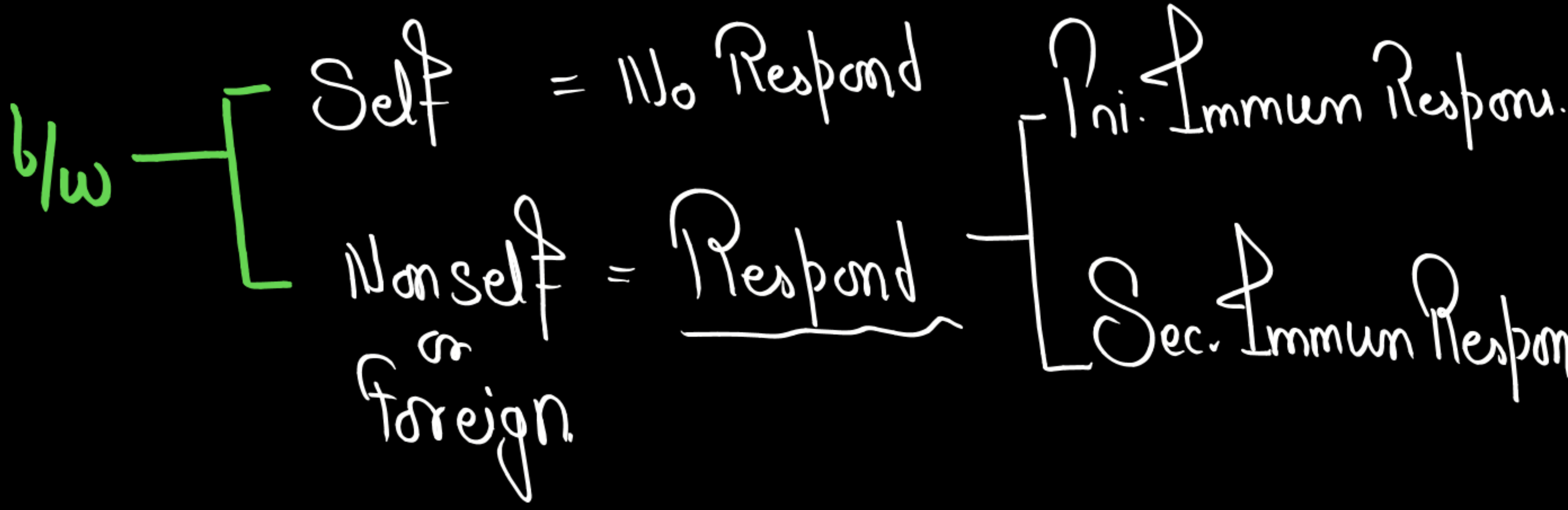
- ACQUIRED IMMUNITY ✓

ACQUIRED IMMUNITY-

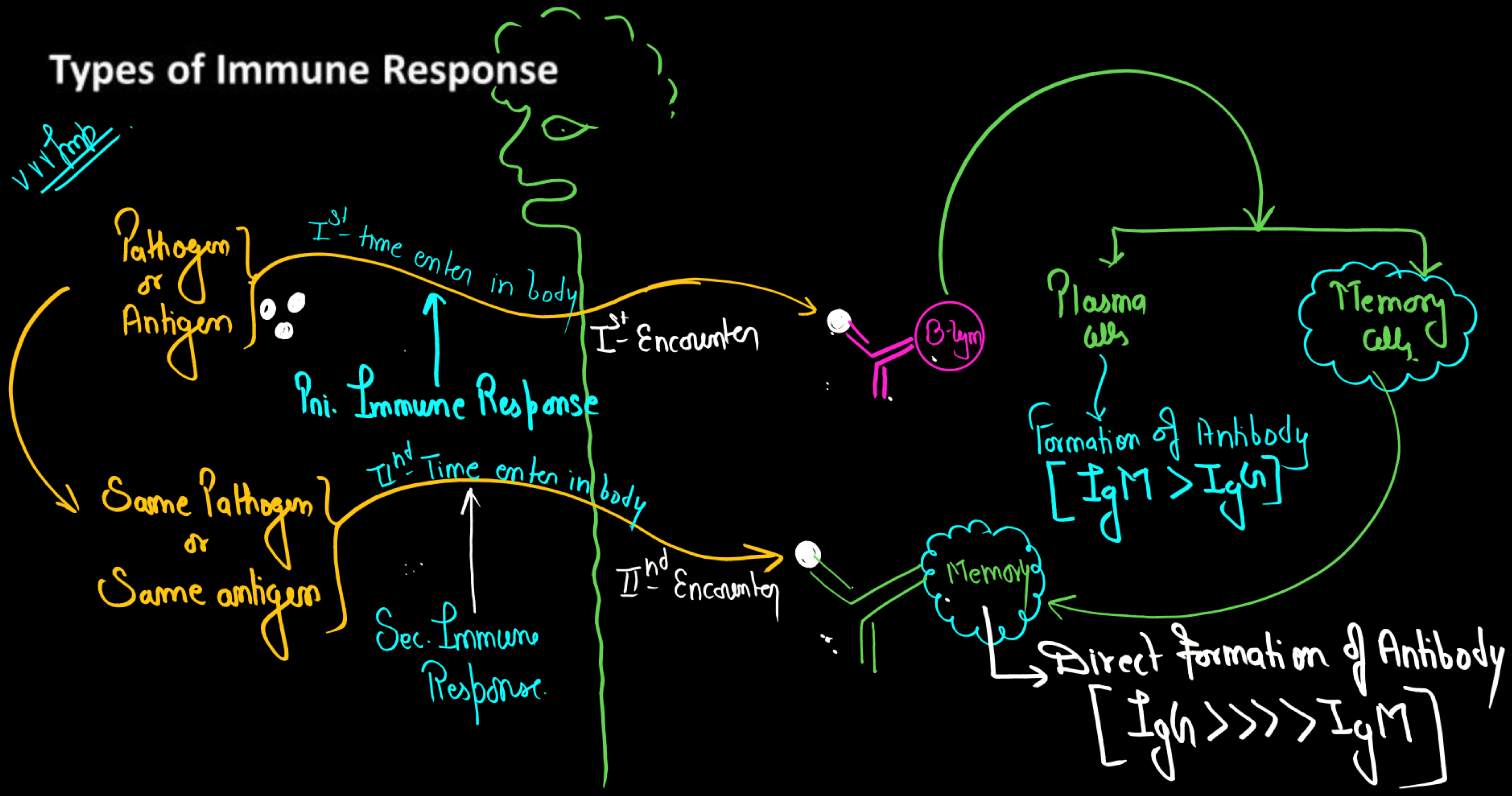
Acquired immunity, on the other hand is pathogen specific. It is characterised by memory.

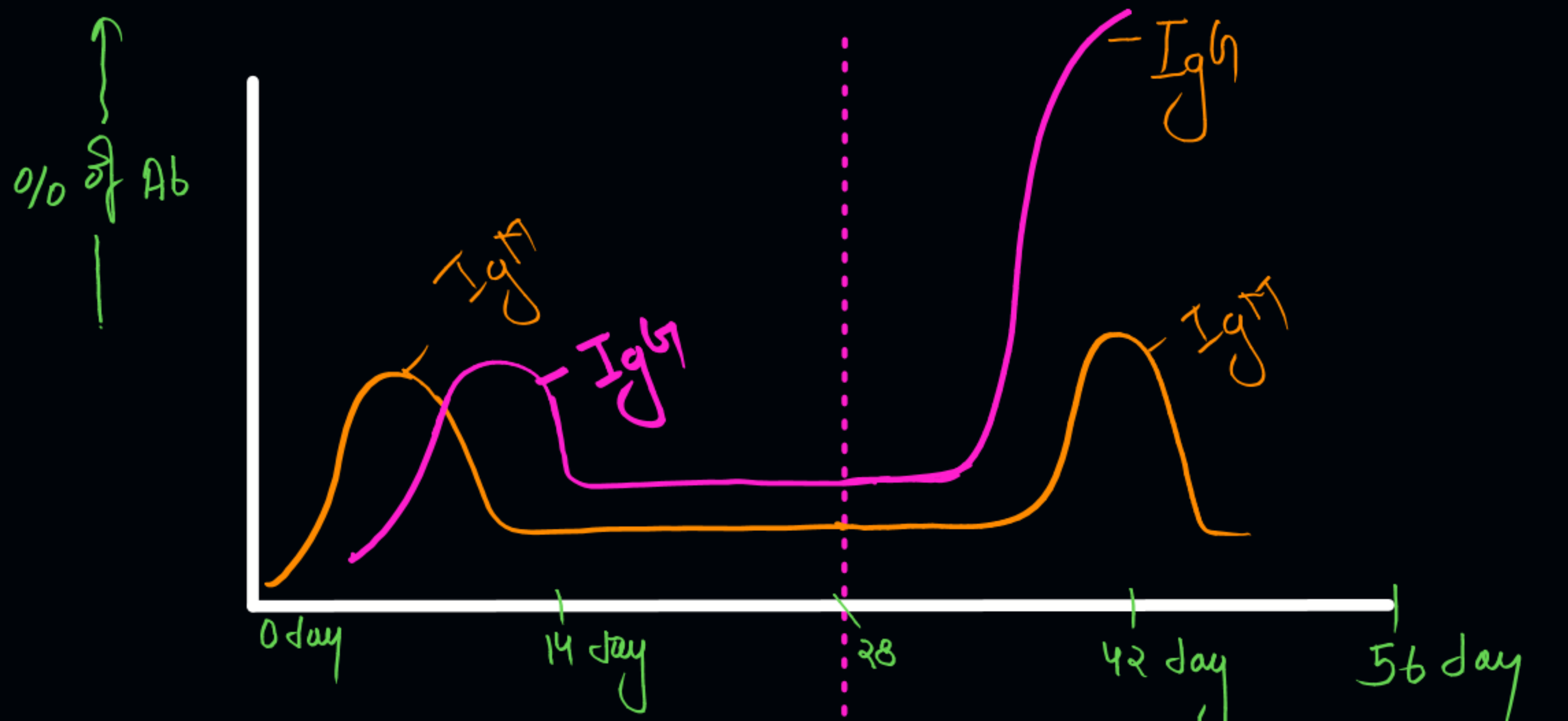
Features of Acquired Immunity –

I. Specificity
II. Diversity
III. Memory
IV. Discrimination



Types of Immune Response





Pri. Immun Response

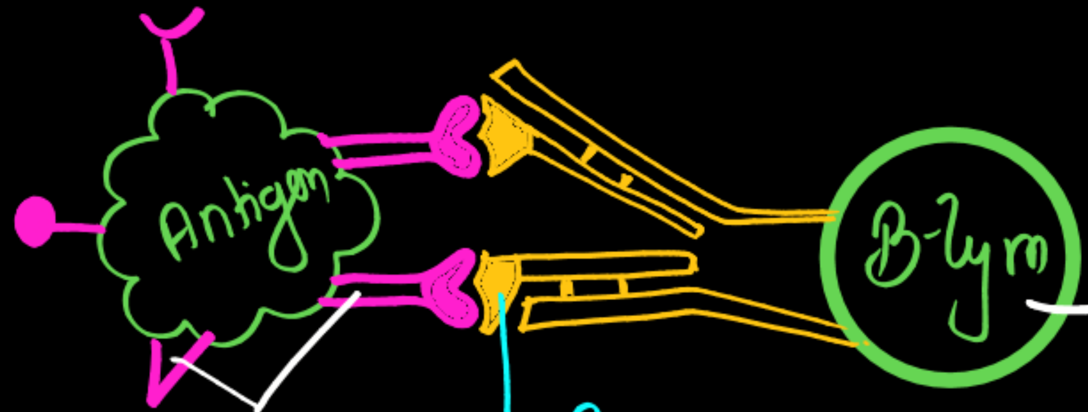
- Ist Encounter.
- Involve - B-lym.
- Low intensity.
- IgM > IgG.

Sec. Immun Response

- IInd Encounter.
- Involve Memory cells.
- High intensity
- IgG >>> IgM.

Antigen (Ag) -

- Molecular wt. ≥ 10,000 D
- Foreign for Host
- Antigenecity
- Immunogenecity



Epitopes ⇌ Paratopes

[Antibody binding Site of Antigen] [Antigen binding Site of Antibody]

Antigenecity

B-lym → Cell Division → Plasma cells, Memory cells

Plasma cells → Formation of A.b (Immunoglobulin)

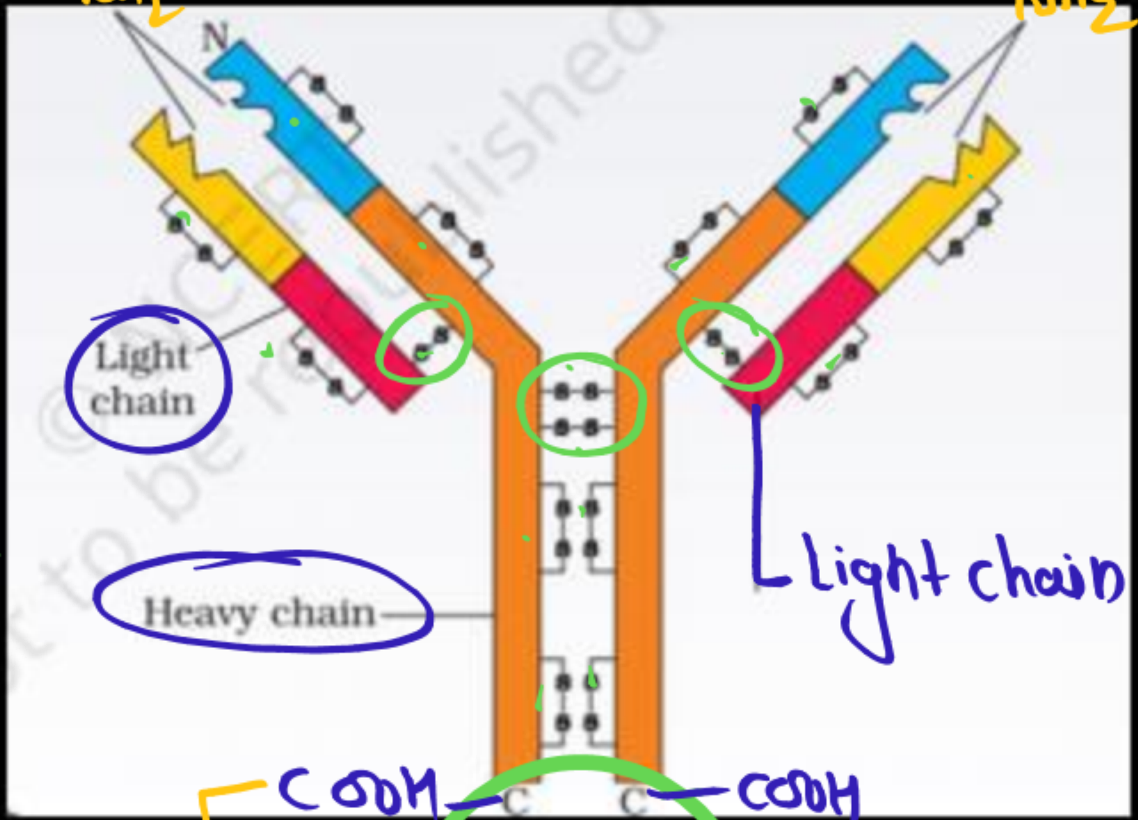
Structure of Antibody (Ab)- [Immunoglobulin] = Nature = Glycoprotein

Polypeptides = 4 (H_2L_2)

- 2 Heavy
- 2 light

Antigen → NH_2 Antigen → NH_2

- No. of Disulphite bond = 16
- b/w = Two Heavy = 2
- b/w = Heavy & light = 2



Light chain

COOH — COOH

Bind with Membrane.

B-lym

- γ = IgG = 80%
- α = IgA = 10-15%
- μ = IgM = 5-10%
- δ = IgD ≃ 1%
- ε = IgE < 1%

Types of Immunoglobulin (Antibody)

IgG (γ)
- Smallest
- Monovalant Structure
- No. of Paratopes = 2
- Cross the Placenta
- Sec. Immun Respons
- tnt in Serum.



IgM (μ)
- Largest
- PantaValant
- No. of Paratopes = 10
- Pri. Immun Response.
- Surface of B-lym.



IgA (α)
- Divalant
- No. of Paratopes = 4
- tnt in body Secretion
- eg – Colostrum, Saliva, Mucus etc.

Provid Passive Immunity



Secretory Peptide

IgD

- Monovalent
- No of Paratopes = ?
- +nt on B-lym.



IgE

- MonoValent
- No. of Paratopes = ?
- +nt on Surface of Mast cells
- Responsible for Allergy.



THANK YOU !!

MANTHAN NEET

HUMAN HEALTH AND DISEASES

LECTURE - 3

ZOOLOGY



MD SIR

TODAY'S GOAL

- ☐ TYPES OF ACQUIRED IMMUNITY
- ☐ ACTIVE AND PASSIVE IMMUNITY
- ☐ VACCINATION AND IMMUNISATION
- ☐ ALLERGIES

Types of Acquired Immunity

B-Lymphocyte Mediated
or
Antibody Mediated Immunity
or
Humoral Immunity
(Humoral = Body fluid)

- Plasma cells [Active B-lym]
- Memory cells [Inactive B-lym]

T-Lymphocytes Mediated Immunity (used in tissue grafting)
or
Cell Mediated Immunity (CMI)

- T_H - Cells = Control Complete Immunity
- T_K - Cells = Kill - Virus Infected Cells & Cancer cells
- T_S - Cells (Suppress)
- T Memory Cells

Tissue graft/ Organ transplantation

1) - Blood Group Matching

2) - Major Histocompatibility Complex [M-H-C] = H.L.A

MHC-I MHC-II

3) - Immunosuppressive Drugs →

eg - Cyclosporins or Cortisol

M-H-C-I → Pnt on all cells

M.H.C-II → Pnt on only antigen Presenting cells eg - { N.K. cells, T-lym.

vvvImp

Active and Passive Immunity

[Active Immunity]
For Prophylaxis

- Antibody Produced by Host
- Long lasting Response.
- Involve
  - B-lym. & T-lym.
  - Memory cells

[Natural Active]
eg- (All Infection)

[Artificial Active]
(All Vaccination)

[Passive Immunity]
For Treatment

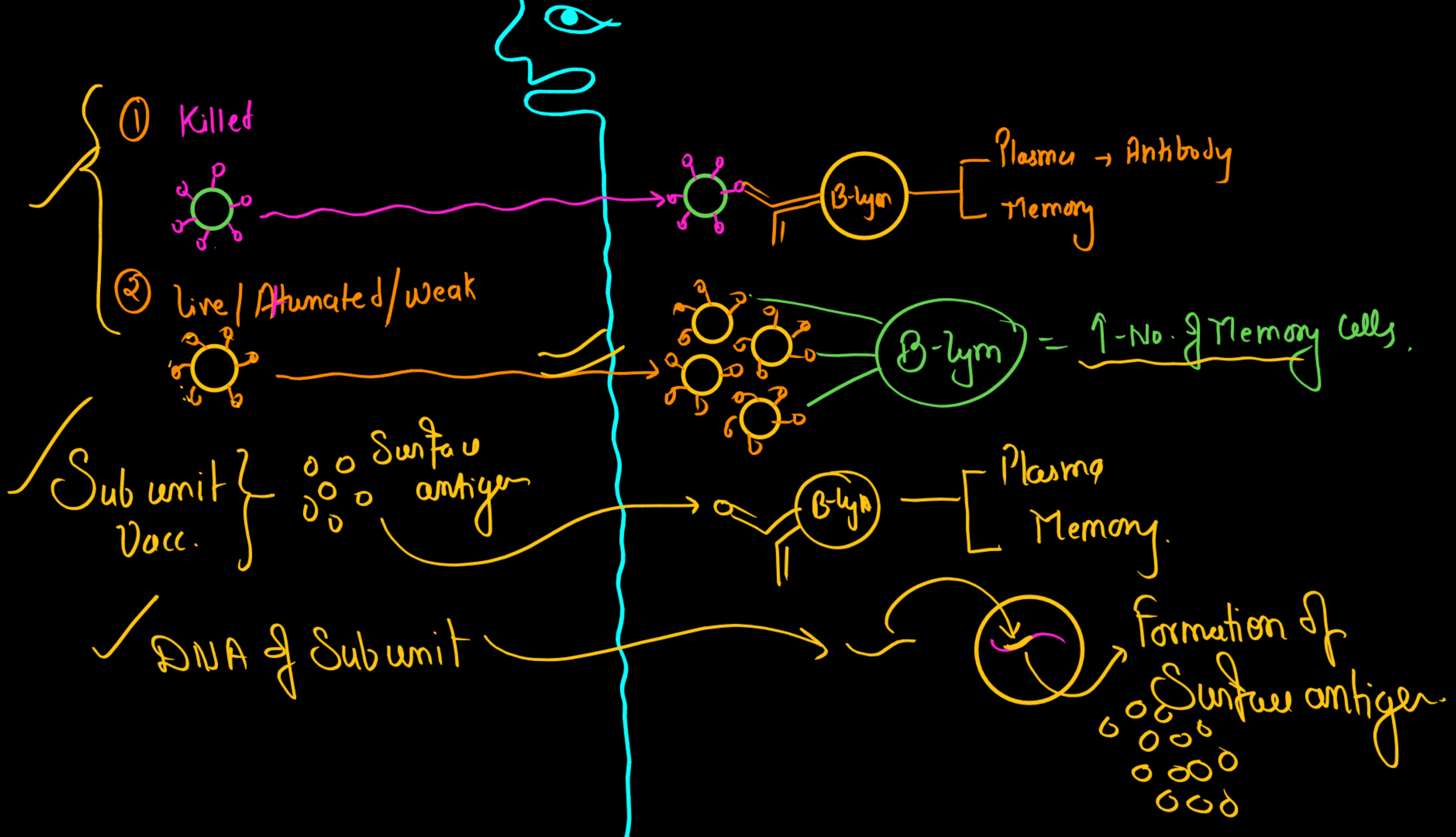
- Prepaired antibody Provided to Host.
- Short live Response.
- —nt

[Natural Passive]
1) Antibody (IgG) Transfer through Placenta
2) → Antibody (IgA) Transfer through Colostrum

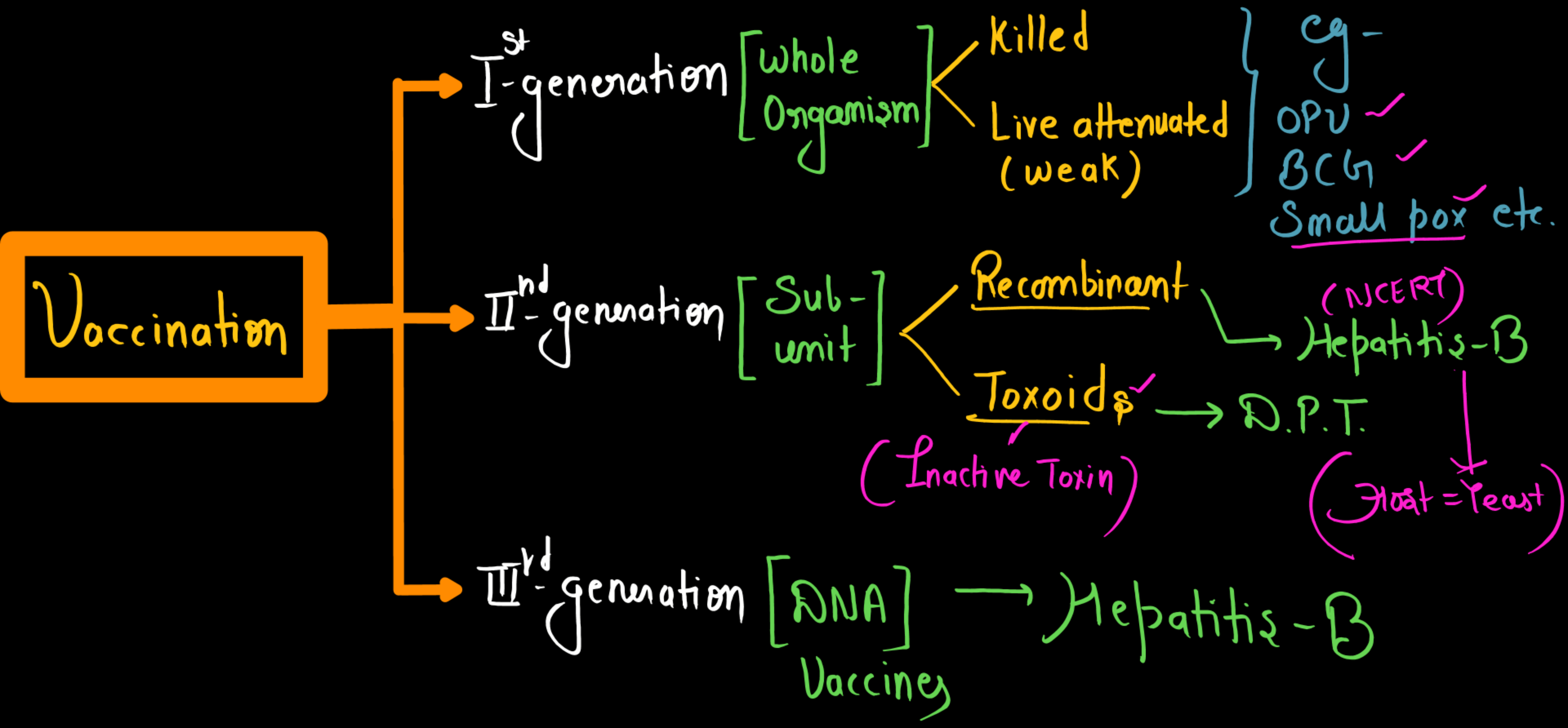
[Artificial Passive.]
- A.T.S Injection
- → AntiVenum

Vaccination and Immunization

- The principle of immunisation or vaccination is based on the property of **'memory'** of the immune system.
- In vaccination, a preparation of **antigenic proteins of pathogen or inactivated/weakened pathogen (vaccine)** are introduced into the body.



① Killed
B-lym
Plasma → Antibody
Memory
② Live / Attunated / weak
B-lym = ↑ No. of Memory cells.
Sub unit Vacc.
Surface antigen
B-lym
Plasma
Memory.
DNA of Subunit
Formation of Surface antigen.



Vaccination
Ist-generation
[whole Organism]
Killed
Live attenuated (weak)
eg-
OPV
BCG
Small pox etc.
IInd-generation
[Sub-unit]
Recombinant
(NCERT)
Hepatitis-B
(Host = Yeast)
Toxoids
(Inactive Toxin)
D.P.T.
IIIrd-generation
[DNA]
Vaccines
Hepatitis-B

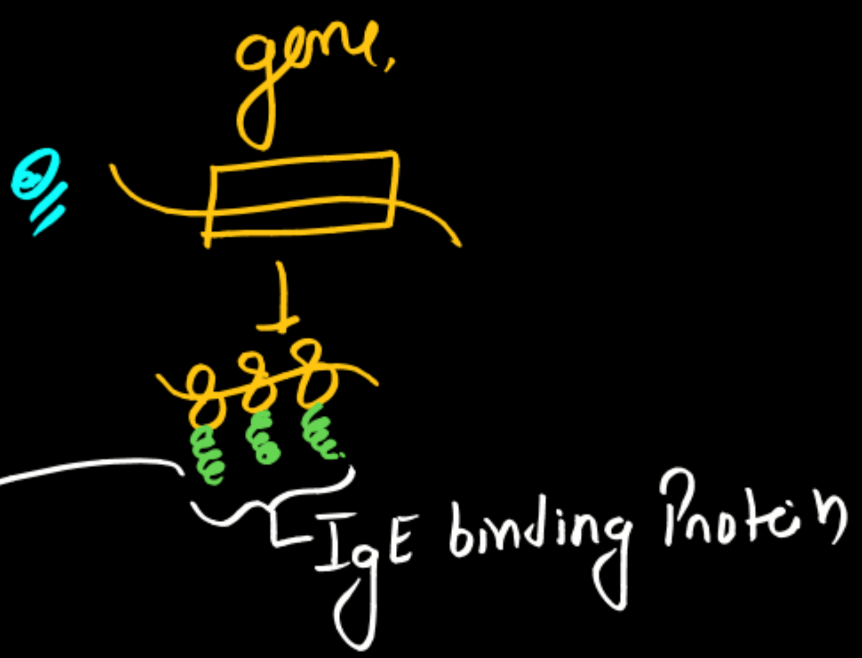
Allergies

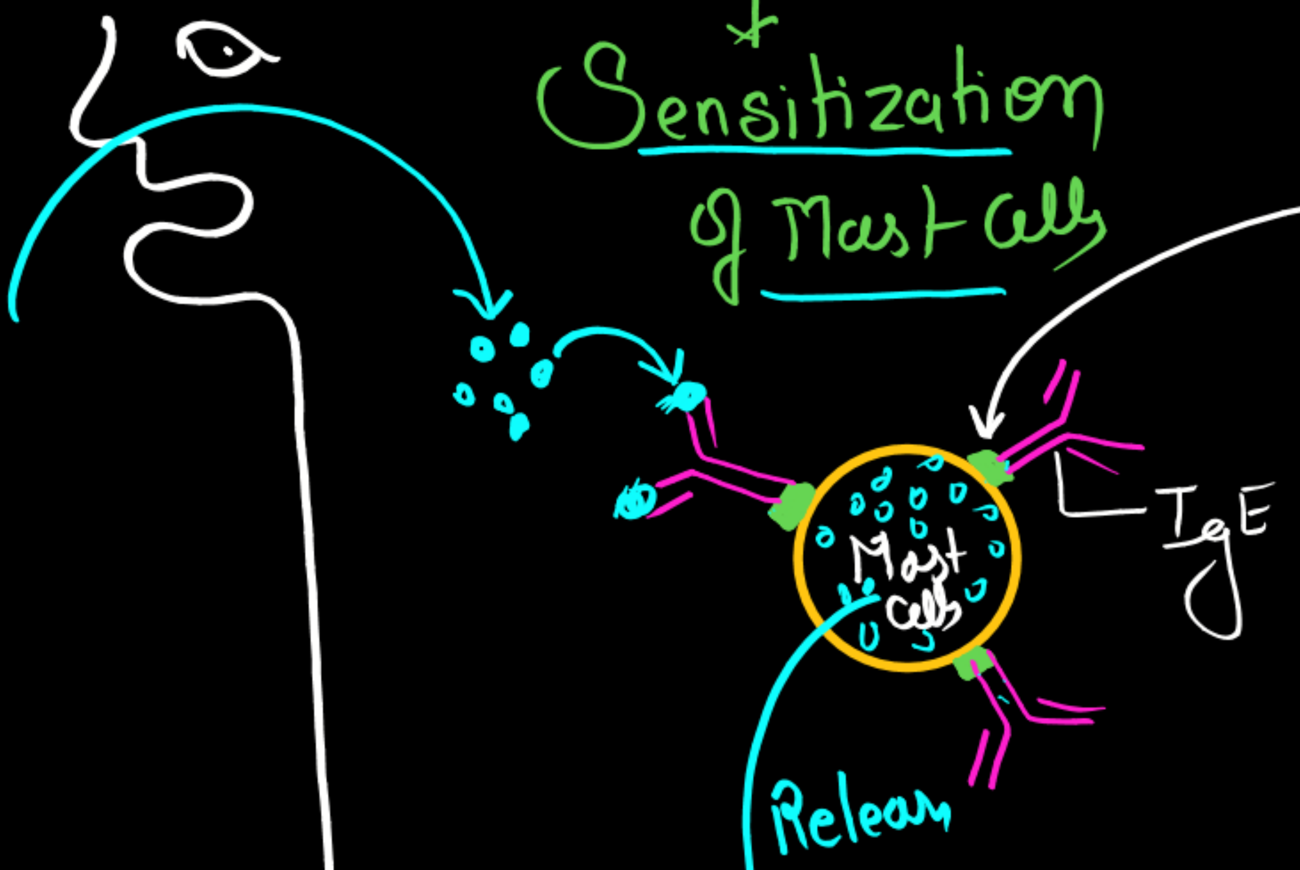
- The exaggerated response of the immune system to certain antigens present in the environment is called **allergy.**
- The substances to which such an immune response is produced are called **allergens.**
- The antibodies produced to these are of **IgE type**.
- Allergy is due to the release of chemicals like **histamine and serotonin** from the mast cells.
- The use of drugs like **anti-histamine, adrenalin and steroids** quickly reduce the symptoms of allergy

or Cortisol

Incase of Allergy

Sensitization of Mast cells





Histamine & Serotonin } Responsible for Allergy

Auto Immunity

- Memory-based acquired immunity evolved in higher vertebrates based on the ability to differentiate foreign organisms (e.g., pathogens) from self cells.
- Most of the experimental immunology deals with this aspect. Two, sometimes, due to genetic and other unknown reasons, the body attacks self-cells. This results in damage to the body and is called auto-immune disease. Eg. Rheumatoid arthritis.

THANK YOU !!

MANTHAN NEET

HUMAN HEALTH AND DISEASES

LECTURE - 4

ZOOLOGY



MD SIR

TODAY'S GOAL

- ❑ Immune system in body
- ❑ Common Diseases in Humans

Immune System in the Body

- The human immune system consists of lymphoid organs, tissues, cells and soluble molecules like antibodies

Types of Lymphoid Organs

[Pri. Lymphoid Organ]

- Proliferation / Division
- Maturation
- Differentiation

} of lymphocytes

eg → Bone marrow = Proliferation of all lymphocytes

→ Thymus = Maturation & Differentiation of T-lymphocyte.

[Sec. Lymphoid Organs]

[Interaction of antigen & antibody]

eg → Spleen - lymph gland.

→ Lymph Nodes

→ Peyer's patches

→ M.A.L.T. = vimp

→ Tonsils

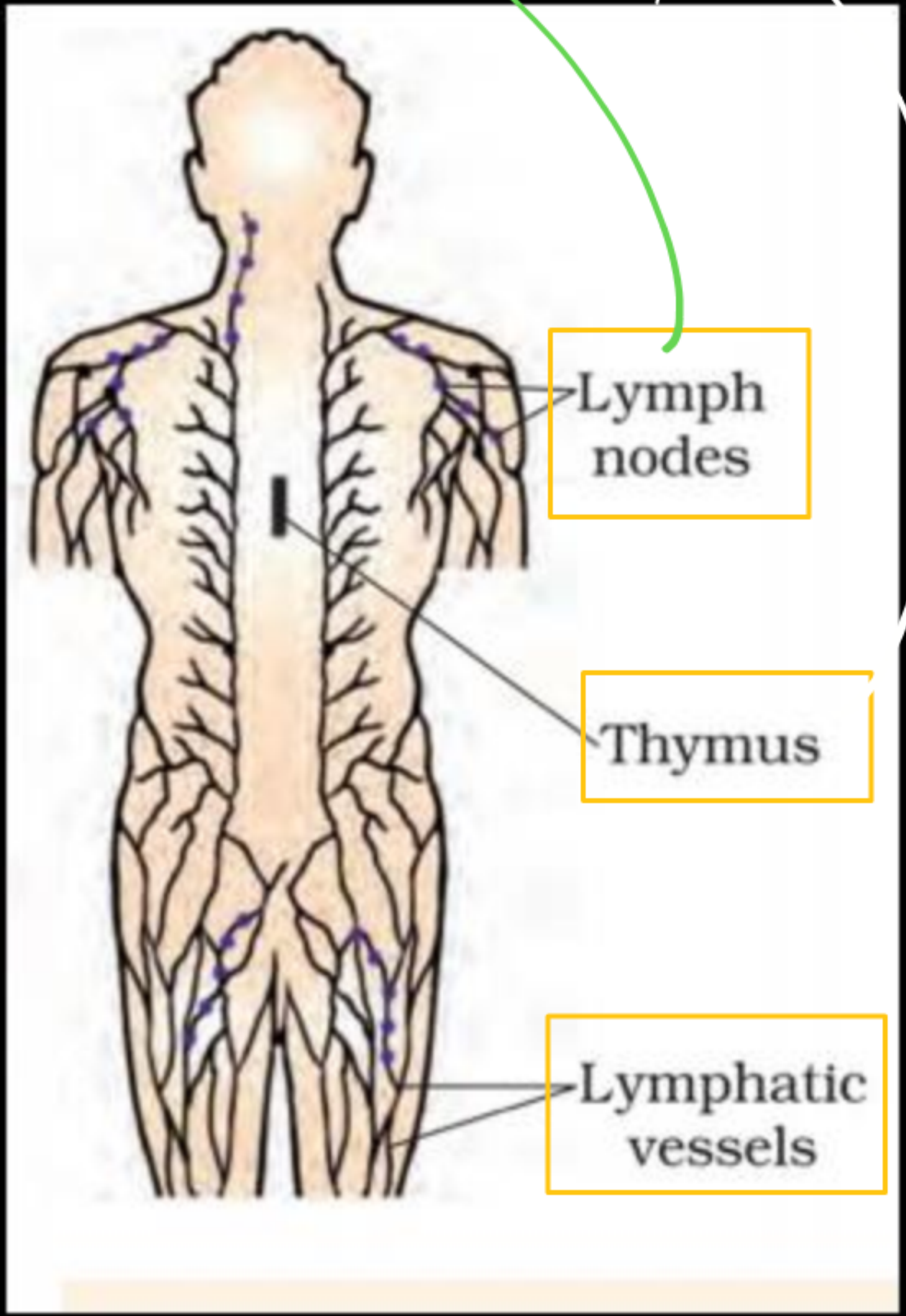
etc

V. Appendix



Position

- Behind Breast bone / Sternum



- M.A.L.T. → 50% of Total Lymphoid Tissue
  - Mucosa Associated Lymphoid Tissue
  - Digestive tract
  - Respiratory tract
  - Urino-genital tract
- Lymphocyte tnt in Mucosa of Tract

Hippocrate – Father of medicine

Health - Health is not only absence of disease.

Health according to –

(1) Hippocrate / Indian Ayurveda-

It is a state of balancing of Certain body Humors

Humors → Body fluid.

- Black Bile = Fever
- Yellow Bile
- Cough.
- Blood

(2) WHO has defined health a state of complete-

- Physical
- Mental
- Social well being.

Our health can be affected by-

- Infections
- Genetic disorders
- Lifestyle.

Our health can be maintained by-

- Balanced diet
- Personal hygiene
- Regular exercise and Yoga
- Awareness about diseases and their effect
- Vaccination (immunisation)
- Proper disposal of wastes
- Control of vectors
- Maintenance of hygiene in food and water resources are necessary for achieving good health

Diseases-

Any Change from Normal State that caused discomfort and affect the working of Organs and system, Characterised by – Some signs & Symptoms

Types of diseases

- Congenital diseases
- Acquired diseases

Types of diseases

Congenital diseases
[Genetical Diseases]

Acquired diseases
[Acquire after Birth]

[Communicable]
[Infectious]

- Spread through Pathogen
  - Bacteria
  - Virus
  - Fungus
  - Helminths
  - etc.

eg → A.I.D.S.

[Noncommunicable]
[Non infectious]

- Spreading -nt

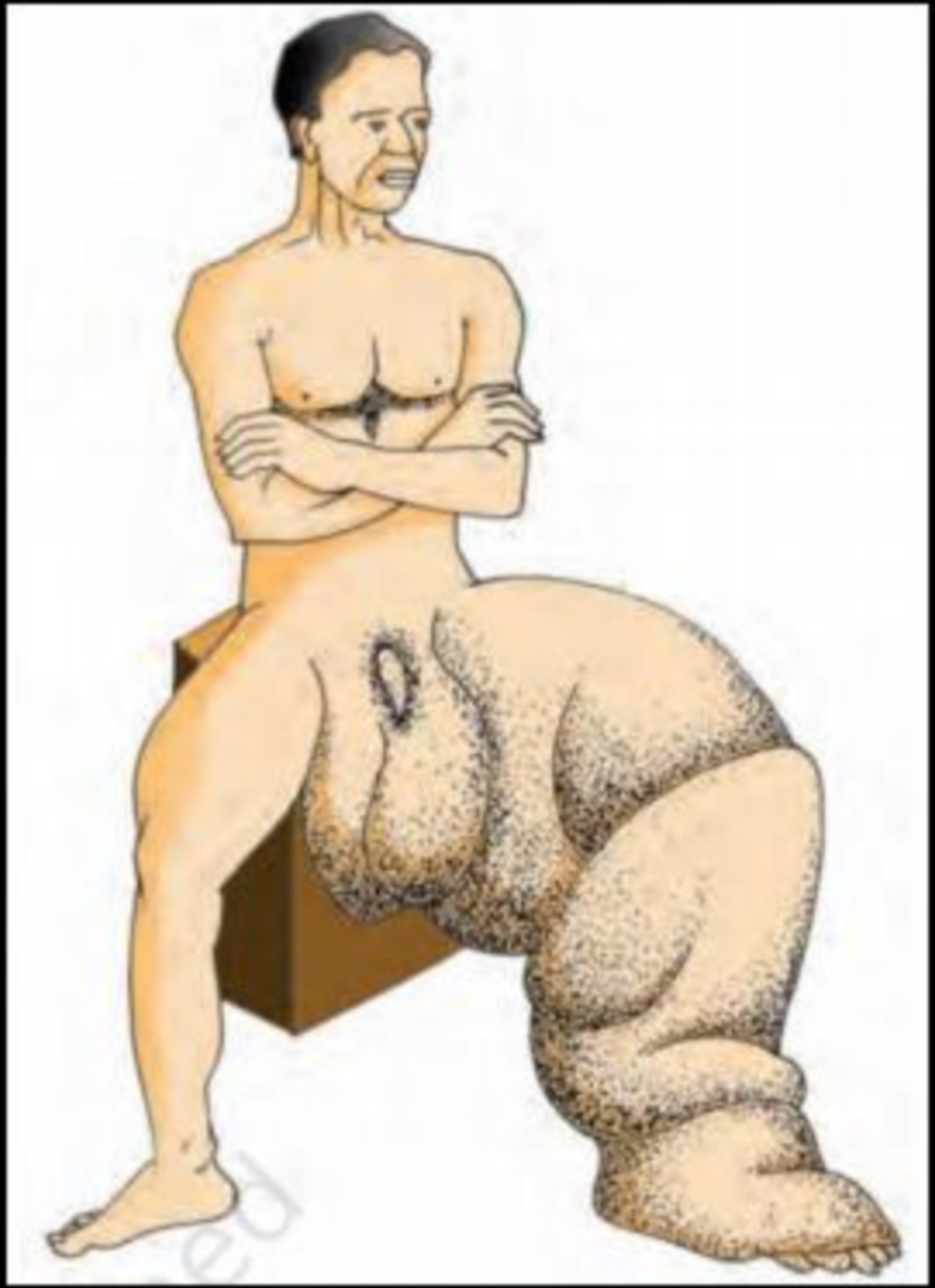
✓. Diabetes Mellitus
✓. Cancer
✓. Deficiency Disorders.
✓. Drugs & Alcohol Abuse

Bacterial Diseases	Pathogen	Symptoms & Pathogenicity
Typhoid	*Salmonella typhi*	➢ Enters small intestine through **contaminated food and water** and migrate to other organs through blood. ➢ Sustained high **fever (39-40°C).** ➢ Weakness, constipation, stomach pain, Headache, loss of appetite. ➢ In severe cases **intestinal perforation, (death).** ➢ Confirmed by **widal test**. ➢ Mary Mallon **nicknamed-Typhoid Mary** (Carrier of typhoid)
Pneumonia	*Streptococcus pneumoniae* *Haemophilus influenzae*	➢ By **droplet or aerosol infection** ➢ Infects alveoli of the lungs. ➢ Alveoli get filled with fluid leading to severe problem in respiration. ➢ Fever with chills, cough & headache. ➢ In **severe cases lips and nails turns gray to bluish in colour**.

Diphtheria	Corynebacterium diphtheriae	➢ High grade fever, affects throat. ➢ Causes suffocation DPT
Plague (Black death)	Yersinia pestis (Parasite of - Rat flea/ Xenopsylla cheopis)	➢ High fever, headache. ➢ Enlargement of axillary lymph nodes ➢ Red patches appear on skin which turns black - Death

Viral Diseases	Pathogen	Symptoms & Pathogenicity
Common cold	Rhino viruses (Group of viruses)	➢ One of the **most infectious** human ailments. ➢ Transmits through **droplet** resulting from cough, sneeze etc. ➢ Infect nose and respiratory passage **but not the lungs**. ➢ Nasal congestion and discharge, sore throat, hoarseness, cough, headache, tiredness. ➢ Usually last **for 3-7 days.**
Hepatitis-B	HBV (ds DNA)	➢ Severe liver damage, jaundice. ➢ Recombination DNA vaccine ➢ Transmits-through parenteral and sexual route (Can cross placenta)
Polio	Polio virus (ss RNA)	➢ Inflammation of nervous system, stiffness of the neck, weakness of particular skeletal muscles. ➢ High fever, pain in body, paralysis of limb muscles.

Helminthic Diseases	Pathogen	Symptoms & Pathogenicity
Ascariasis	Ascaris Lumbricoides (Common Round worm)	➢ Intestinal parasite ➢ Internal bleeding, muscular pain, fever, anaemia, blockage of the intestinal passage. ➢ Eggs of the parasite excreted along with the faeces of infected person which contaminate soil, water, plants etc. ➢ Infection occurs by taking contaminated water, fruits, vegetables etc.
Elephantiasis (Filariasis)	Wuchereria (W. bancrofti) (Filarial worm)	➢ Slowly developing chronic inflammation of the organs in which they live for many years. ➢ Usually the lymphatic vessels of the lower limbs get blocked. ➢ Genital organs are also often affected, (swelling in tests & scrotum). ➢ Transmitted to a healthy person through the bite by the female mosquito vector (Mainly Culex).



Elephantiasis
(Filariasis)

Fungal Diseases	Pathogen	Symptoms & Pathogenicity
Ringworms	**Microsporum, Trichophyton & Epidermophyton**	➢ One of the most common infectious disease. ➢ Appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp. ➢ Generally acquired from soil or by using towels, clothes or even the comb of infected individuals.



Figure 8.3 Diagram showing ringworm affected area of the skin

THANK YOU !!

MANTHAN NEET

HUMAN HEALTH AND DISEASES

LECTURE - 5

ZOOLOGY



MD SIR

TODAY'S GOAL

- Protozoan Diseases in Humans

Protozoan Diseases

(1) Malaria

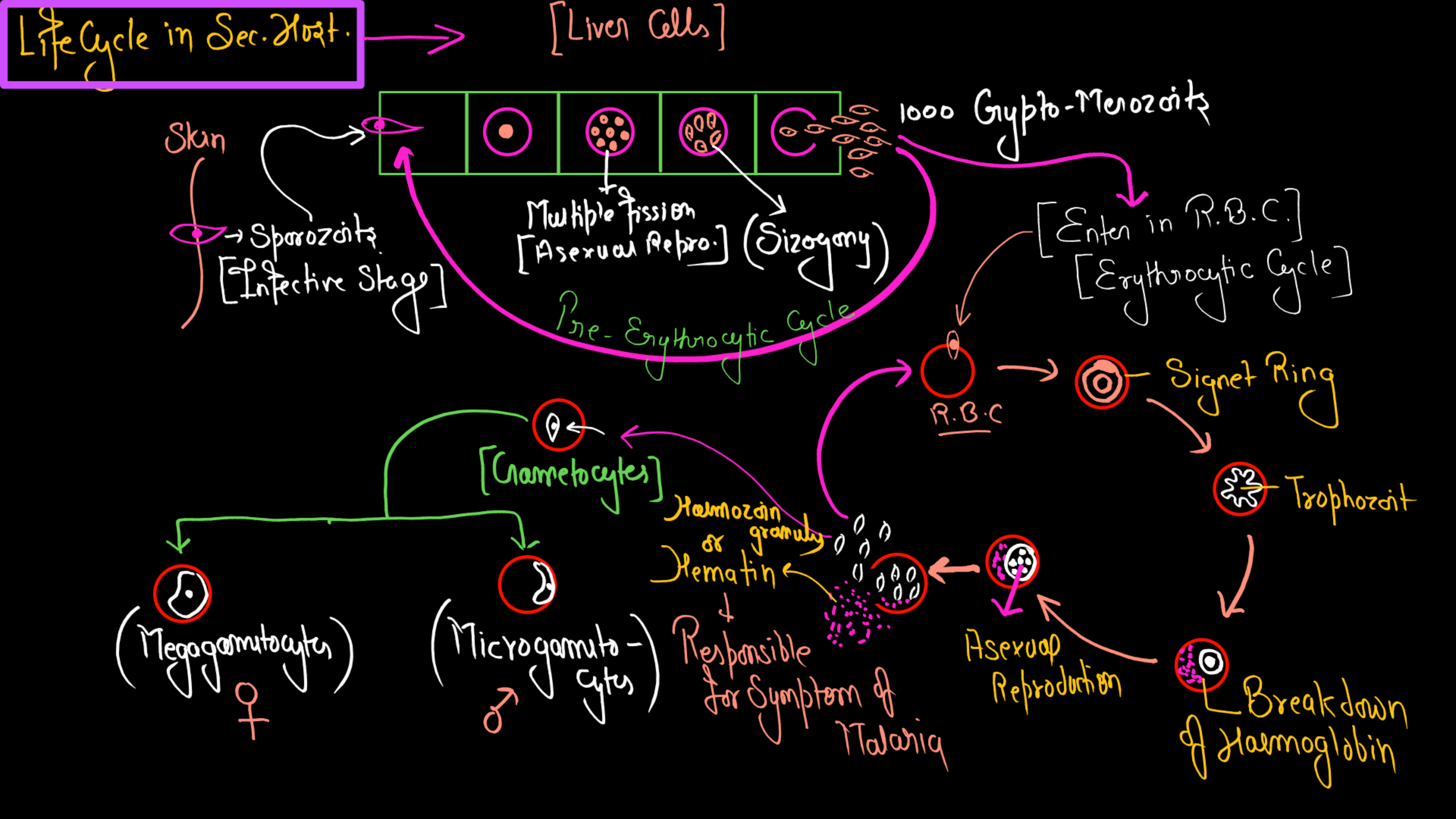
Different species of Plasmodium which infect humans are-

- P. Vivax → Benign Tertian Malaria.
- P. Malaria → Quartain Malaria.
- P. falciparum → Malignant Tertian Malaria.

Life cycle of Plasmodium →

* Life cycle = Digenetic (Complete in two Host)

- [Pri. Host] (Sexual Part)
  - ↓ Female Anopheles Mosquito [In Stomach]
- [Sec. Host or Intermediated Host] (Asexual Part)
  - ↓ Human
    - (Liver)
    - (R.B.C.)



Life Cycle in Sec. Host.
[Liver Cells]
1000 Crypto-Merozoits
Skin
Sporozoits
[Infective Stage]
Multiple fission
[Asexual Repro.]
(Sizogony)
Pre-Erythrocytic Cycle
[Enter in R.B.C.]
[Erythrocytic Cycle]
R.B.C
Signet Ring
Trophozoit
Breakdown of Haemoglobin
Asexual Reproduction
Haemozoin granules
or
Hematin
Responsible for Symptom of Malaria
[Gametocytes]
(Megagamitocytes)
♀
(Microgamito-cytes)
♂

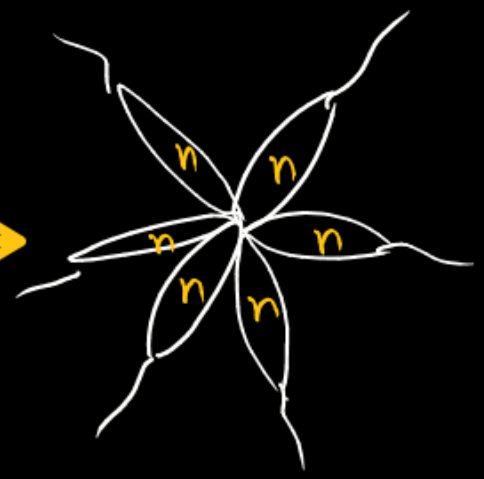
Life Cycle in Mosquito → (Stomach)

1) - Gametogenesis →

Male gametes. =



Exflagellation
(Mitotic)



Male gametes.

Female gametes =

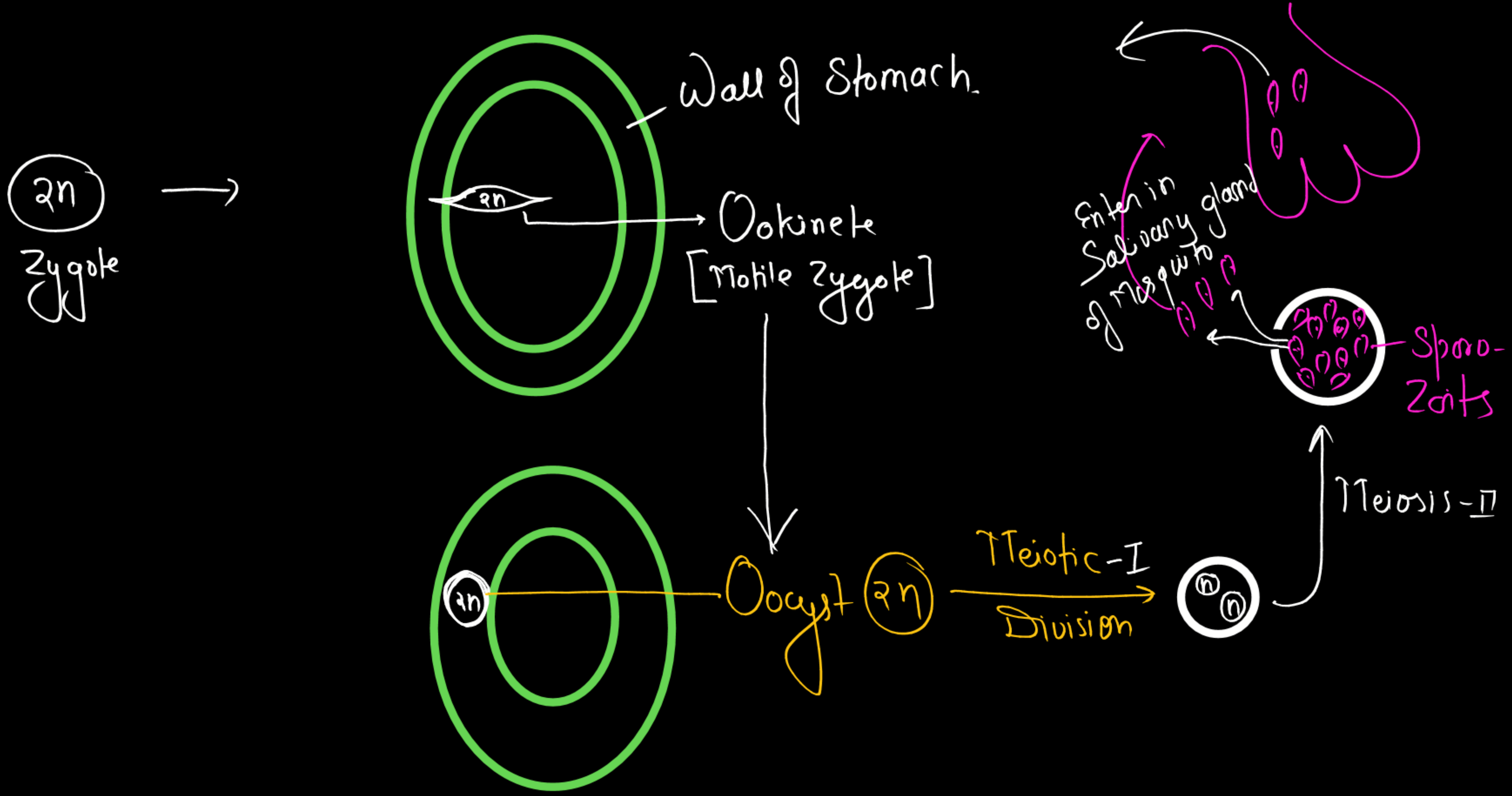


(Mitotic)



2) - Fertilization in Stomach of Mosquito →



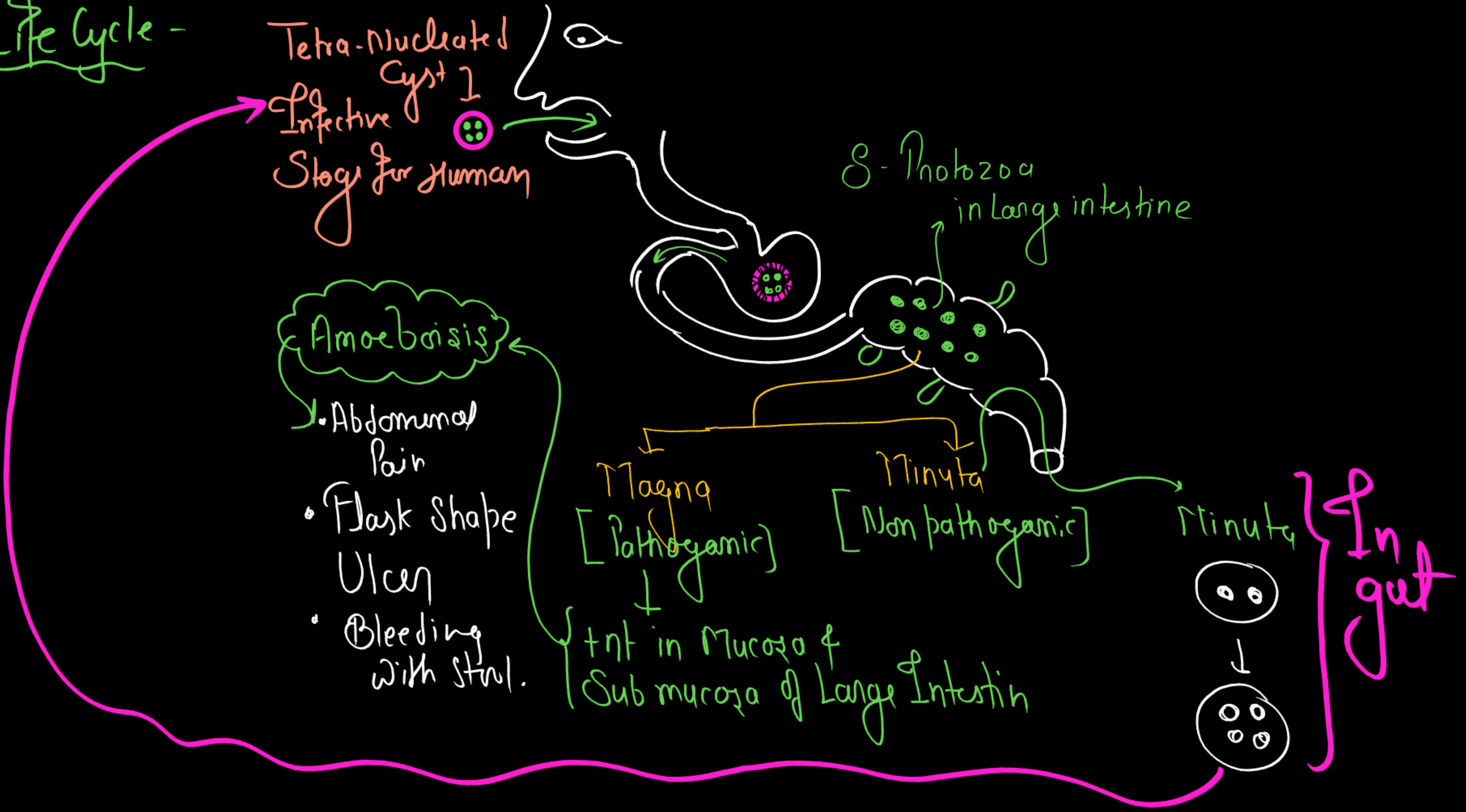


2n
Zygote
Wall of Stomach
2n
Ookinete
[Motile Zygote]
2n
Oocyst 2n
Meiotic-I
Division
n n
Meiosis-II
Sporozoits
Enter in Salivary gland of Mosquito

(2) Amoebiasis (amoebic dysentery)- Caused by *entamoeba histolytica* (parasite in the large intestine of human)

- Life cycle = Monogenetic (Human)
- Transmit by = Mechanical Carrier (House fly)
- Through → Contaminated - Food & Water

Life Cycle -


Tetra-Nucleated Cyst
Infective Stage for Human
S- Protozoa in Large intestine
Amoebiasis
• Abdominal Pain
• Flask Shape Ulcer
• Bleeding with Stool.
Magna
[Pathogenic]
Minuta
[Non pathogenic]
Int in Mucosa & Sub mucosa of Large Intestin
Minuta
In gut

THANK YOU !!

MANTHAN NEET

HUMAN HEALTH AND DISEASES

LECTURE - 6

ZOOLOGY



MD SIR

TODAY'S GOAL

- ❑ Cancer
- ❑ AIDS

Cancer

- Cancer is one of the most dreaded diseases of human beings and is a major cause of death all over the globe.
- More than a million Indians suffer from cancer and a large number of them die from it annually

Difference between Normal Cell and Cancer Cell

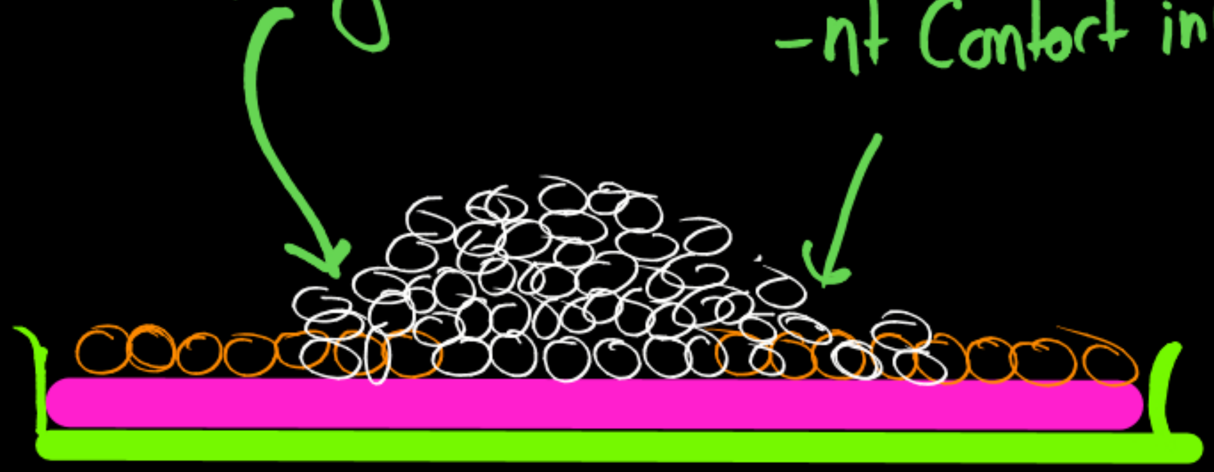
Normal Cell	Cancer Cell
Control Cell Division	Uncontrol Cell Division
Contact inhibition +nt	-nt
Invegireness -nt	+nt

Contact inhibition



Invegireness

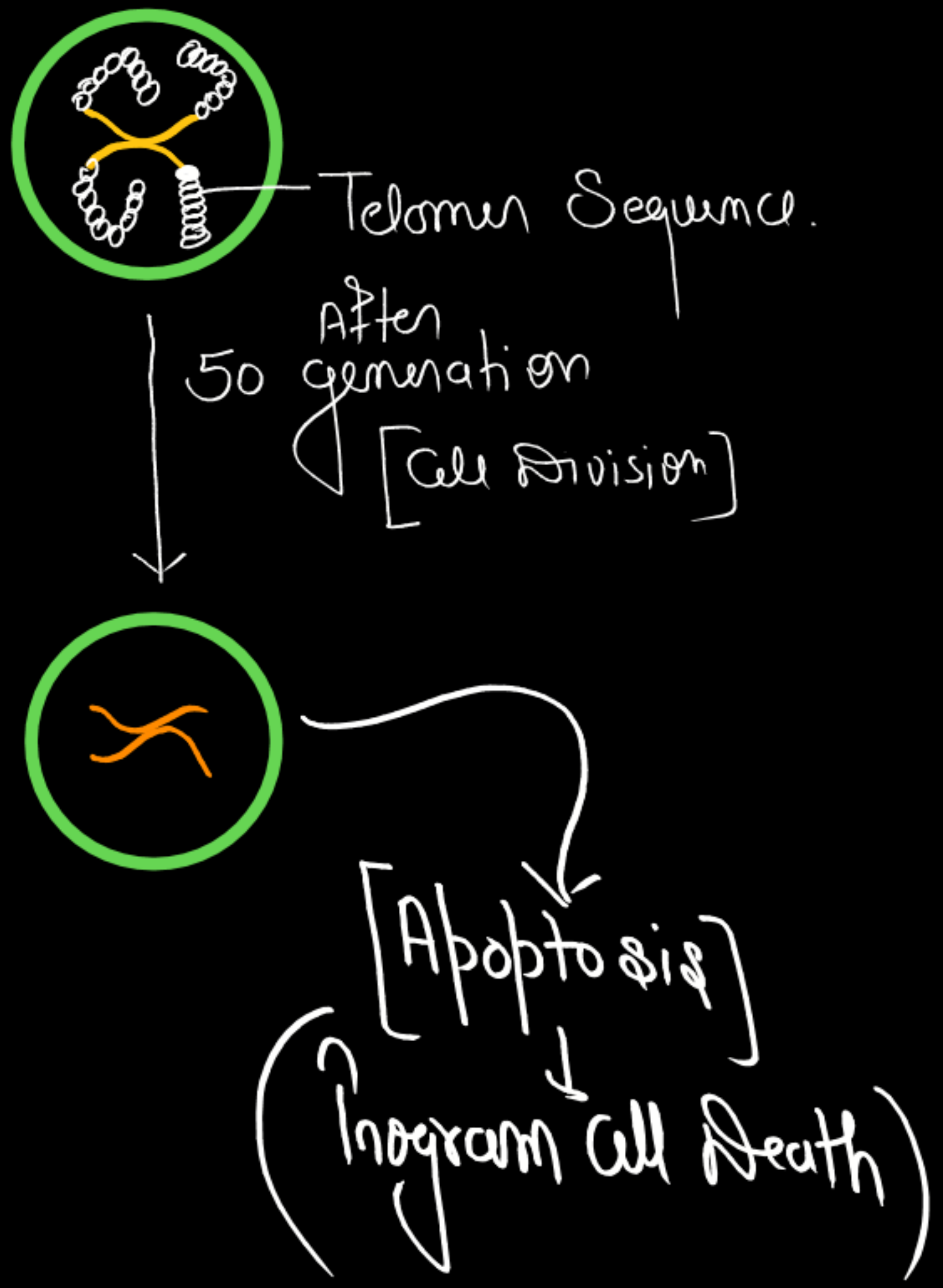
-nt Contact inhibition

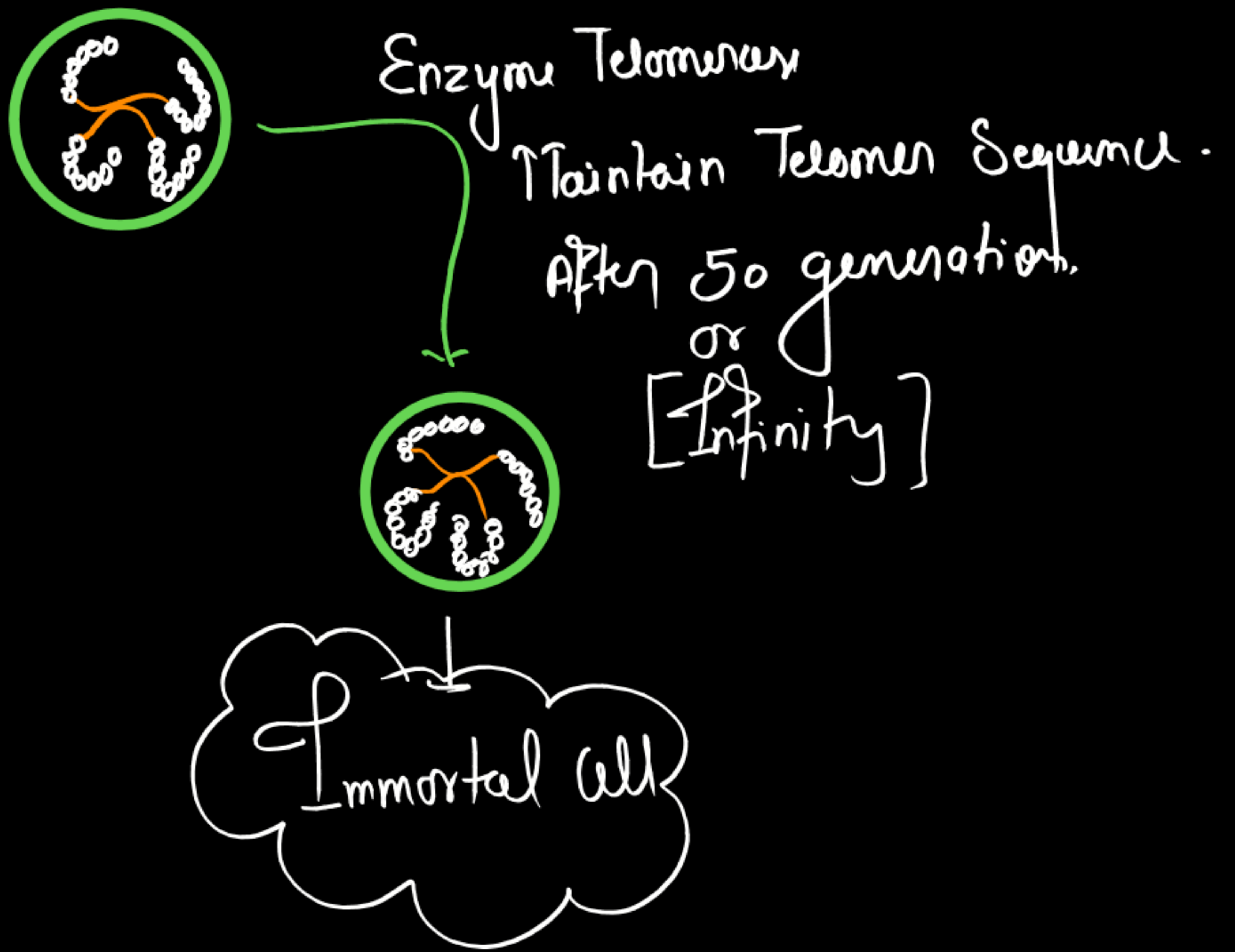


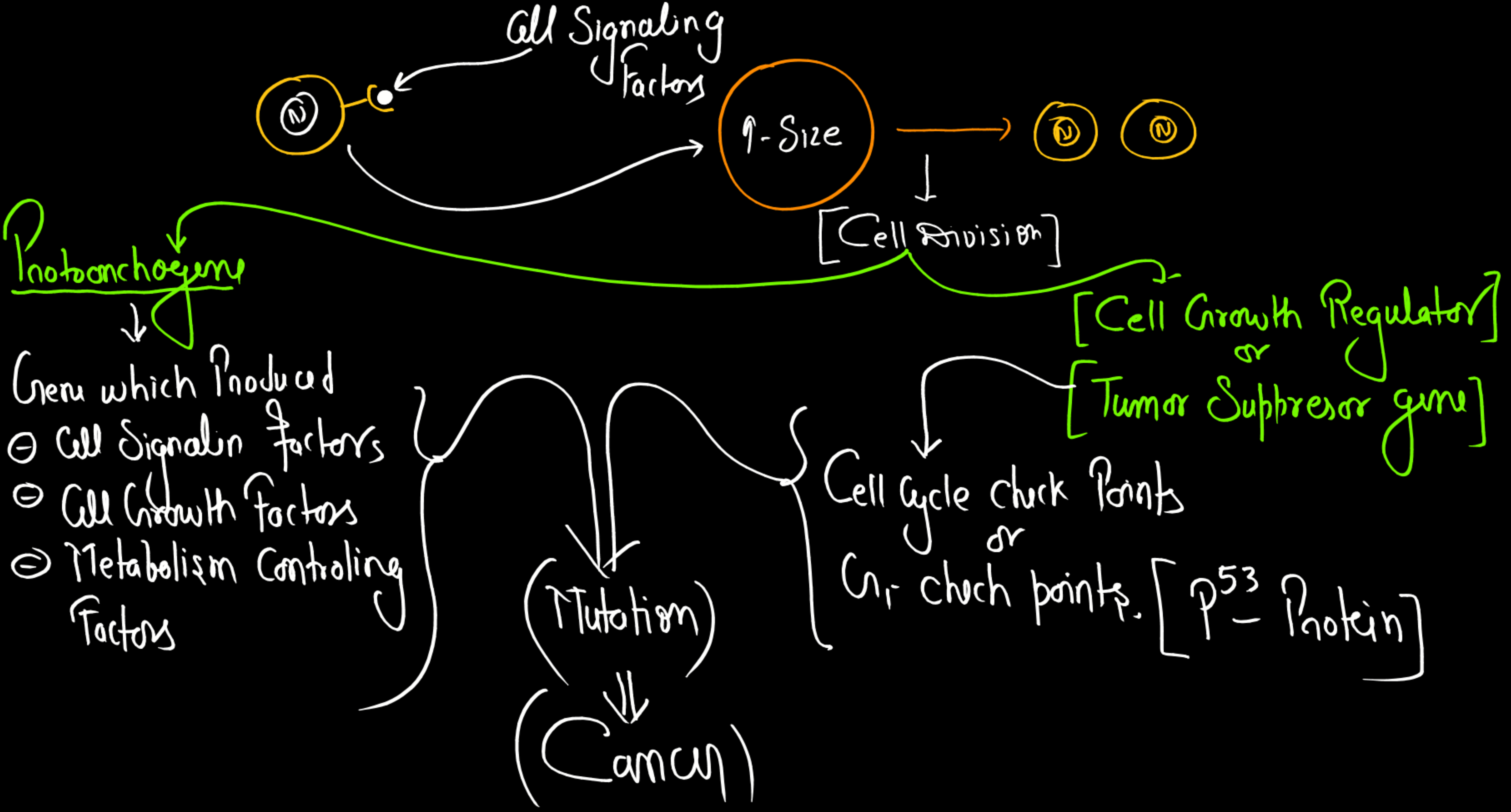
- Mortal Cells

(Immortal Cells)

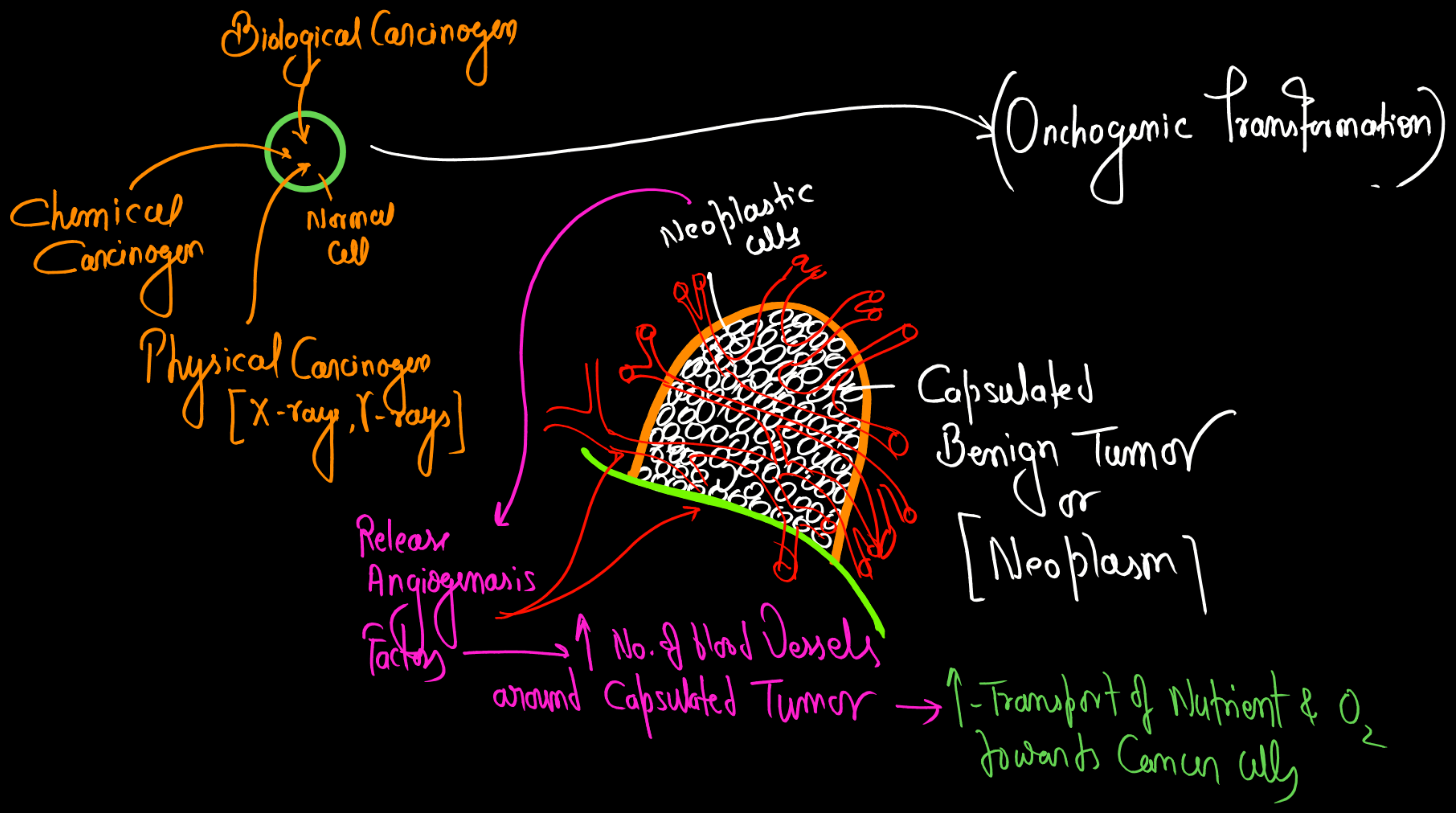
× Enzyme - Telomerase = Inactive | = Active.

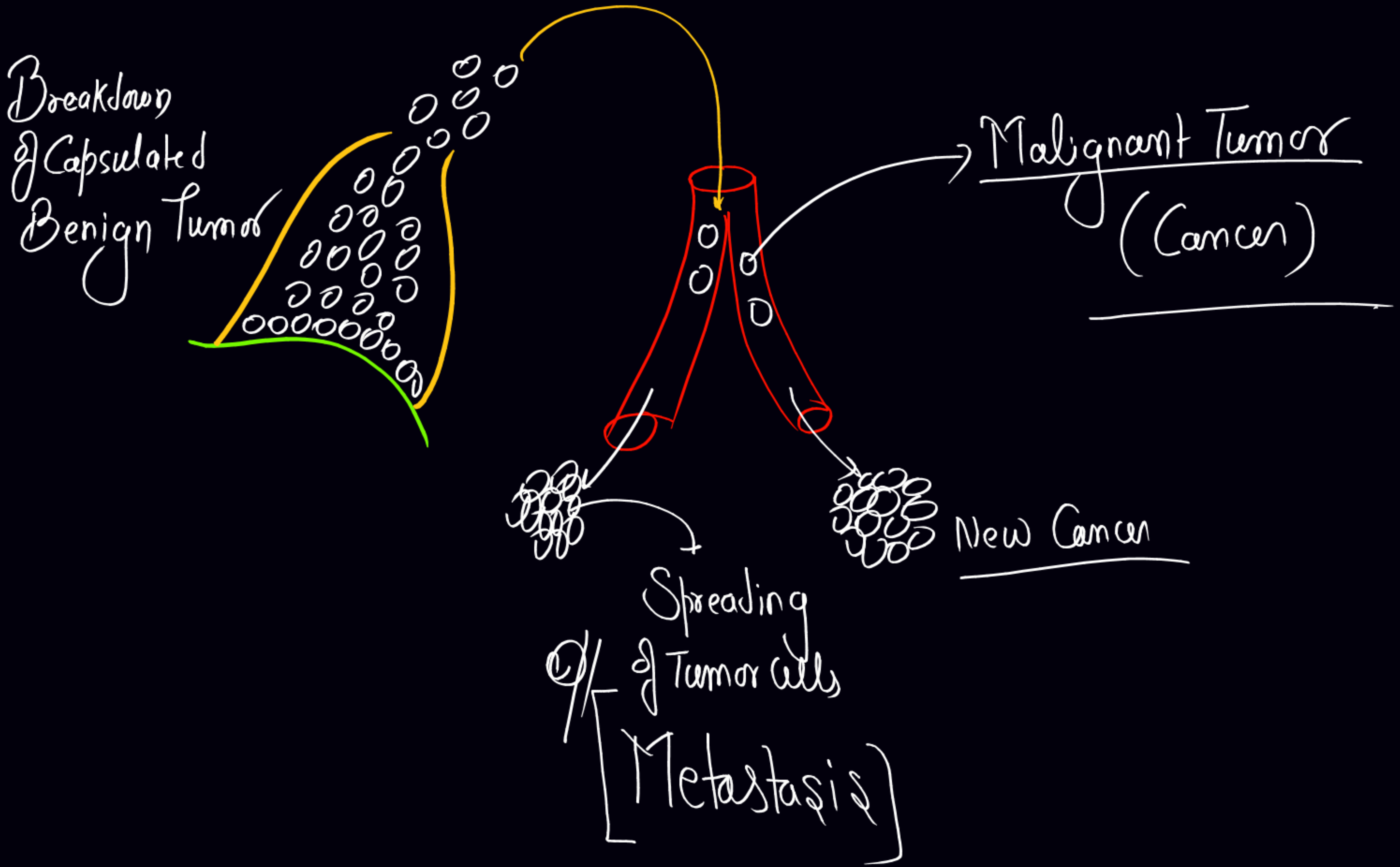






Cell Signaling Factors
N
↑- Size
N
N
[Cell Division]
Protooncogene
Gene which Produced
⊖ Cell Signalin factors
⊖ Cell Growth factors
⊖ Metabolism Controling Factors
[Cell Growth Regulator]
or
[Tumor Suppresor gene]
Cell Cycle check Points
or
G1- check points. [P53 - Protein]
(Mutation)
(Cancer)


Biological Carcinogen
Chemical Carcinogen
Physical Carcinogen [X-rays, γ-rays]
Normal cell
(Onchogenic Transformation)
Neoplastic cells
Capsulated Benign Tumor or [Neoplasm]
Release Angiogenasis Factor
↑ No. of blood vessels around Capsulated Tumor
↑ Transport of Nutrient & O2 towards Cancer cells



Breakdown of Capsulated Benign Tumor
Malignant Tumor
(Cancer)
New Cancer
Spreading of Tumor cells
or
[Metastasis]

Types of Cancer →

1) Carcinomas [Ectodermal & Endodermal] = 85%

2) Sarcomas [Mesodermal Tissue]

3) Lymphomas or Blood Cancer. } Uncontrol Growth of W.B.C.

Causes of cancer :

Physical, chemical or biological agents. These agents are called carcinogens.

Physical carcinogens –

- Ionising radiations – X-rays and gamma rays
- Non-ionizing radiations – UV cause DNA damage

Chemical carcinogens-

Tobacco smoke have been identified as a major cause of lung cancer etc.

Biological agents –

Cancer causing viruses called oncogenic viruses like – HPV, HBV etc.

Cancer detection and diagnosis :

- Biopsy and histopathological studies
- Radiography (use of X-rays),
- CT (computed tomography)
- MRI (magnetic resonance imaging) ← Safest technique
- Antibodies against cancer -specific antigens are also used for detection of certain cancers.
- Techniques of molecular biology can be applied to detect genes in individuals with inherited susceptibility to certain cancers.

Treatment of cancer :

The common approaches for treatment of cancer are

- Surgery
- Radiation therapy
- Chemotherapy – Vincristine and vinblastine
- Immunotherapy - α-interferon

THANK YOU !!

MANTHAN NEET

HUMAN HEALTH AND DISEASES

LECTURE - 7

ZOOLOGY



MD SIR

TODAY'S GOAL

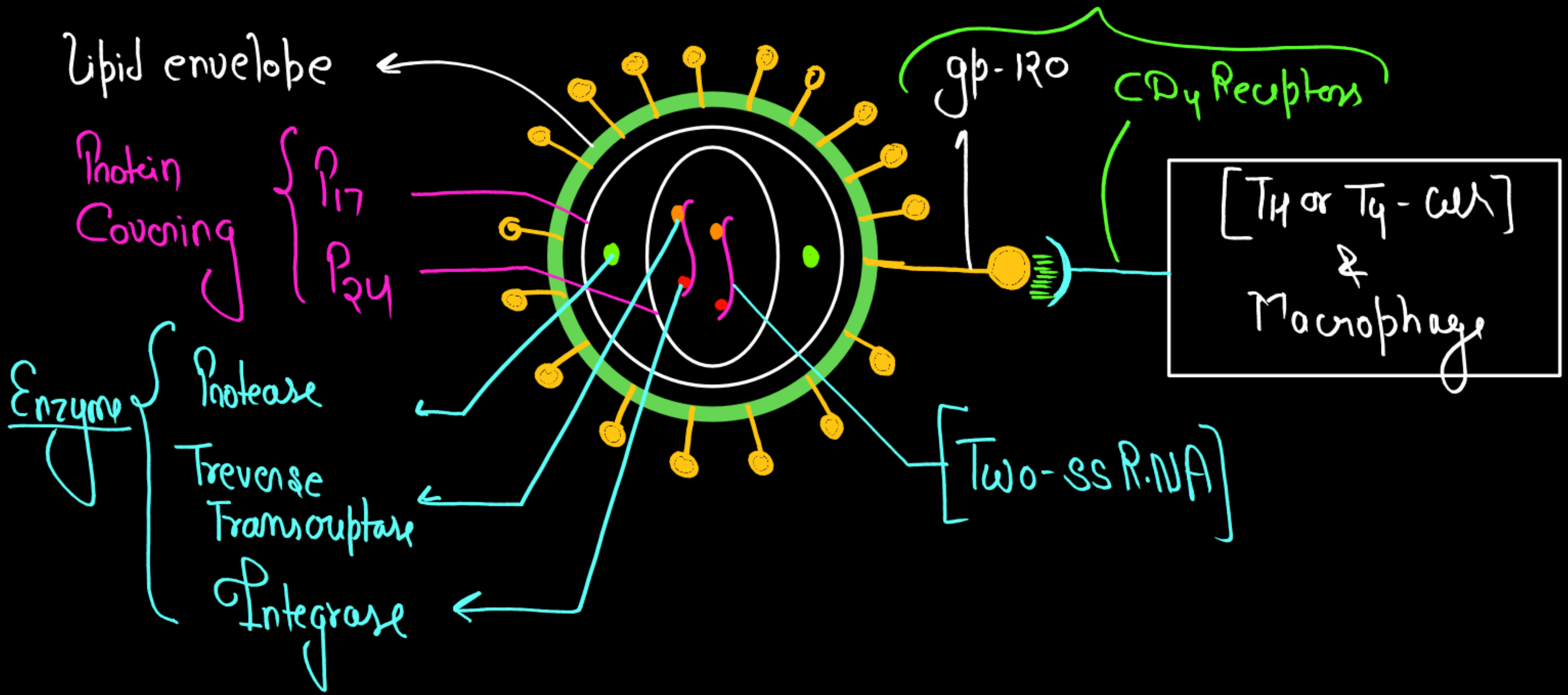
- ❑ AIDS
- ❑ Drugs

AIDS

- The word AIDS stands for **Acquired Immuno Deficiency Syndrome.** This means deficiency of immune system, acquired during the lifetime of an individual indicating that it is not a congenital disease.
- 'Syndrome' means a group of symptoms.
- AIDS was first reported in **1981** and in the last twenty-five years or so, it has spread all over the world killing more than **25 million persons**

HIV

- AIDS is caused by the Human Immuno deficiency Virus (HIV), a member of a group of viruses called **retrovirus,** which have an **envelope enclosing the RNA genome**.



Transmission of HIV infection

Transmission of HIV-infection generally occurs by -

(a) sexual contact with infected person,

(b) by transfusion of contaminated blood and blood products,

(c) by sharing infected needles as in the case of intravenous drug abusers,

(d) From infected mother to her child through placenta.

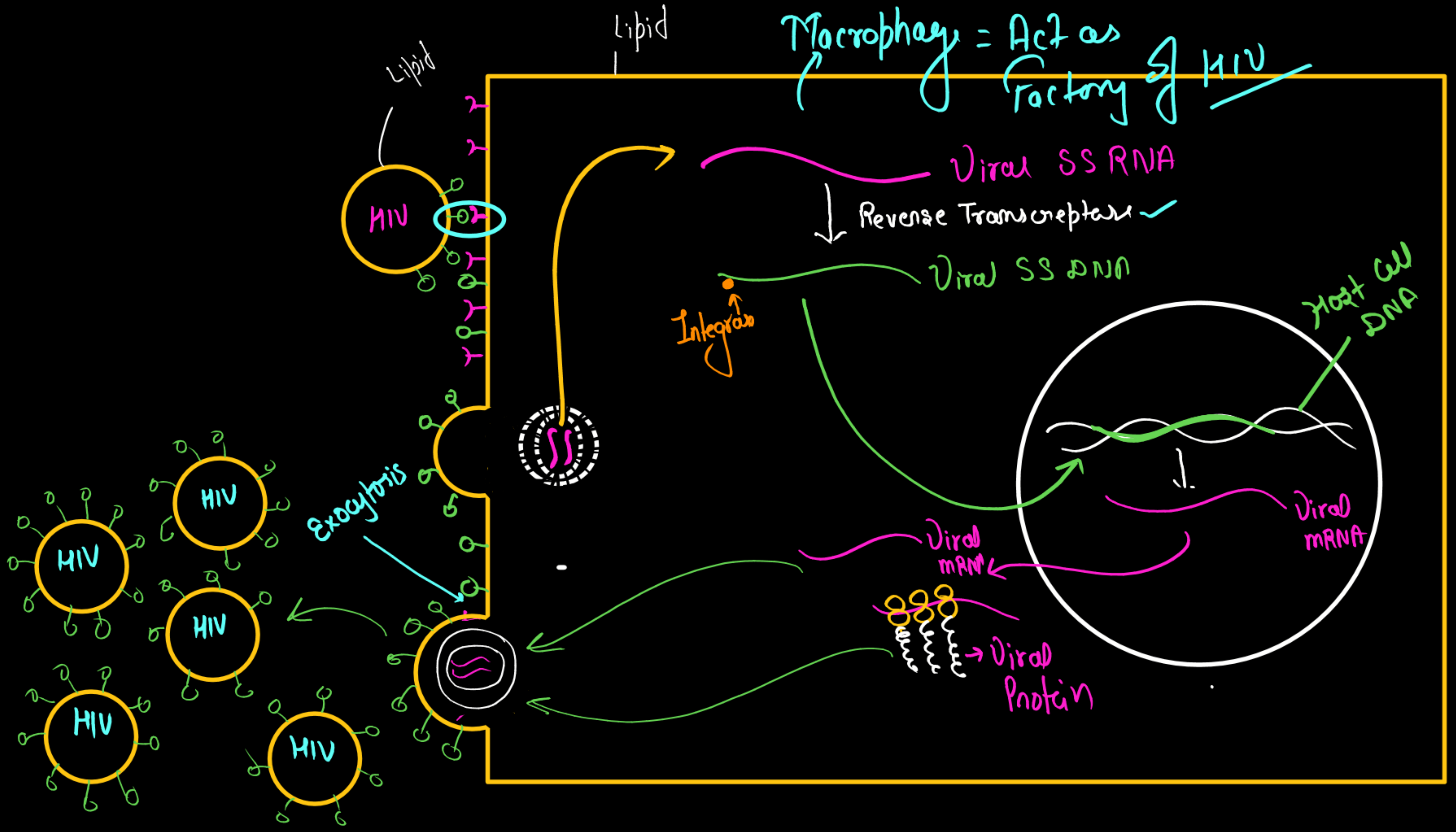
So, people who are at high risk of getting this infection includes -

a) Individuals who have multiples sexual partners,
b) Drug addicts who take drugs intravenously,
c) Individuals who require repeated blood transfusions and
d) Children born to an HIV infected mother.

- It is important to note that HIV/AIDS is not spread by mere touch or physical contact; it spreads only through body fluids.
- It is, hence, imperative, for the physical and psychological well-being, that the HIV/AIDS infected persons are not isolated from family and society.
- There is always a time-lag between the infection an appearance of AIDS symptoms. This period may vary from a few months to many years (usually 5-10 years).

Life cycle of HIV-

- After getting into the body of the person, the virus enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase.
- This viral DNA gets incorporated into host cell's DNA and directs the infected cells to produce virus particles.
- The macrophages continue to produce virus and in this way acts like a HIV factory.
- Simultaneously, HIV enters into helper T-lymphocytes (TH), replicates and produce progeny viruses. The progeny viruses released in the blood attack other helper T-lymphocytes.



Macrophag = Act as Factory of HIV
Lipid
Lipid
HIV
Viral SS RNA
Reverse Transcreptase
Viral SS DNA
Integras
Host cell DNA
Viral mRNA
Viral mRNA
Viral Protein
Exocytosis
HIV
HIV
HIV
HIV
HIV

- This is repeated leading to a progressive decrease in the number of helper T- lymphocytes in the body of the infected person.

Note = No. of T_H-Cells in Non infected Person = $1200/mm^3$

v.Imp

if No. of T_H-Cell $\leq 200/mm^3$

$\Downarrow$

(Symptom of AIDS Start due to opportunistic infection)

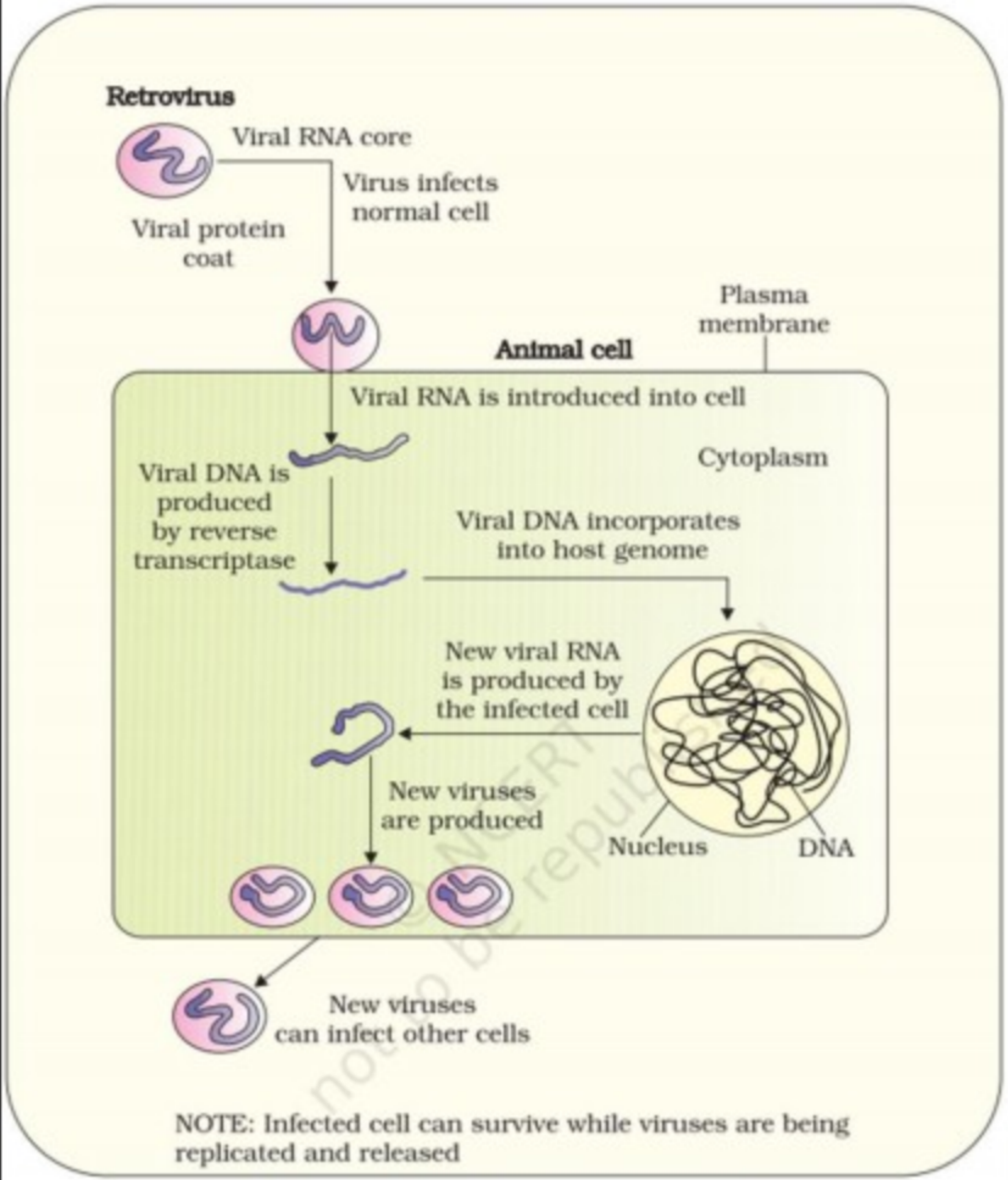


Figure 8.6 Replication of retrovirus

Symptoms –

- The person suffers from bouts of fever, diarrhoea and weight loss.
- Due to decrease in the number of helper T lymphocytes, the person starts suffering from infections that could have been otherwise overcome such as those due to bacteria especially Mycobacterium, viruses, fungi and even parasites like Toxoplasma

opportunistic infection

Diagnostic test and Treatment

- A widely used diagnostic test for AIDS is - Enzyme Linked Immuno-Sorbent Assay (ELISA). Confirmation test – Western blotting

- Treatment of AIDS with anti-retroviral drugs is only partially effective.
- They can only prolong the life of the patient but cannot prevent death, which is inevitable.

Reverse Transcreptase inhibitor —
- A.Z.T.

Protease inhibitor
- RitonaVir

Prevention of AIDS :

- As AIDS has no cure, prevention is the best option.
- In our country the National AIDS Control Organisation (NACO) and other non-governmental organisation (NGOs) are doing a lot to educate people about AIDS.



DRUGS AND ALCOHOL ABUSE

- The drugs, which are commonly abused are opioids, cannabinoids and coca alkaloids. Majority of these are obtained from flowering plants. Some are obtained from fungi.

THANK YOU !!

MANTHAN NEET

HUMAN HEALTH AND DISEASES

LECTURE - 8

ZOOLOGY



MD SIR

SANKALP NEET VEDANTU

TODAY'S GOAL

- ❑ Drugs ✓

DRUGS AND ALCOHOL ABUSE

- The drugs, which are commonly abused are opioids, cannabinoids and coca alkaloids. Majority of these are obtained from flowering plants. Some are obtained from fungi.

DRUGS

Psychotropic
(Mood altering)

eg - Tranquillizer
- Opioids
- Stimulants

Psychedelic
(Hallucinogenic)

eg - Canabinoids
- Datura
- Atropa bellodona
- L.S.D. (Synthetic)

Tranquillizer

- ✓ → Anesthetic
- ✓ → Depressant
- ✓ → Sleeping drugs
- ✓ → ↑- Tranquility

eg - Benzodiazepine (Valum) + Barbitur

- ✓ → Anxiety
- ✓ → Insomnia
- ✓ → Schizophrinia
- → Action mechanism

Action mechanism → (↑-G.A.B.A in Brain)

Opioids

- Narcotics ✓
- Sedative ✓
- Depressents ✓
- Analgesic (Pain Killer) ✓
- Euphoriant ✓

Isolate from = Papaver Somniferum (opium poppy) = Latex

↓

[Contain = 20 Alkaloids]

⇓

Main alkaloids = Morphine.

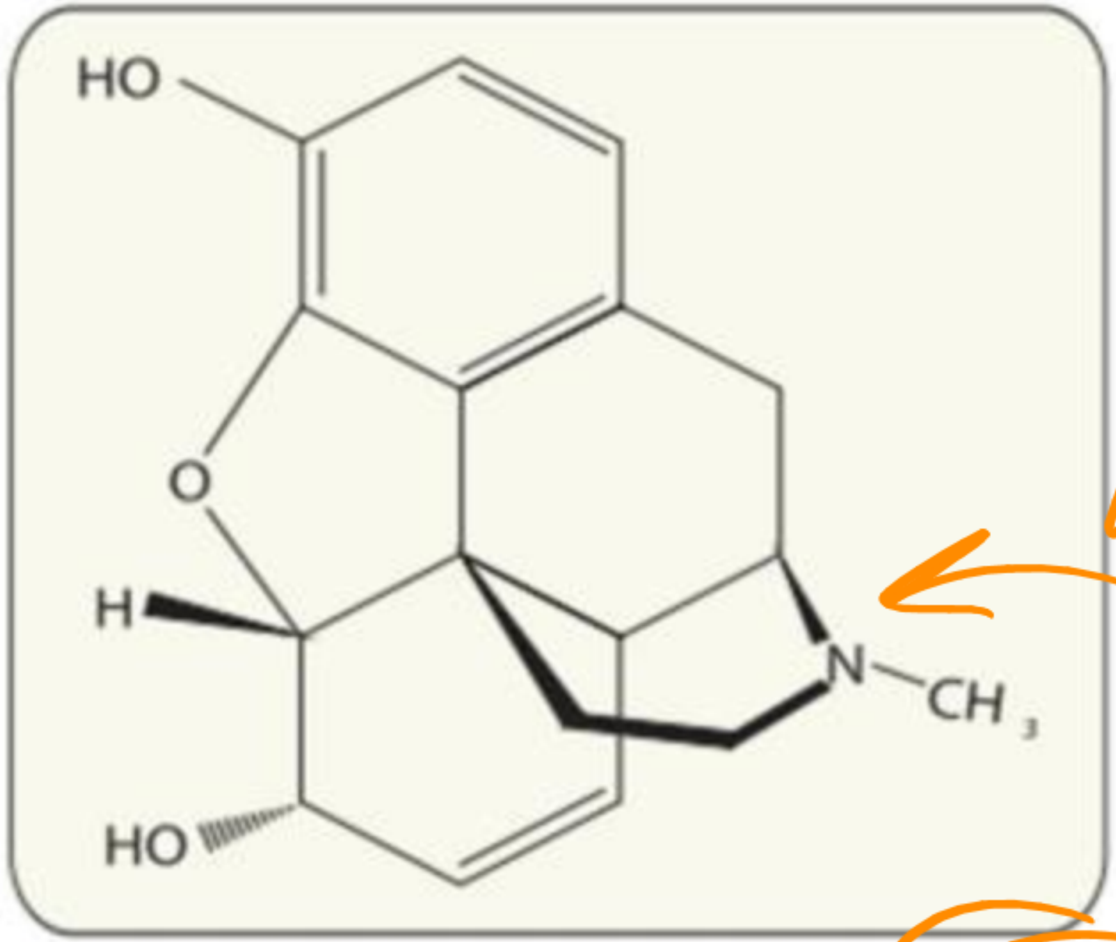


Figure 8.7 Chemical structure of Morphine



Figure 8.8 Opium poppy

Morphine → Analgesic (Painkiller)

Receptor tnt on < Brain ✓, Gut ✓

Morphine — Methylation → (Codein)

(Codein) → Methyl-morphine

used in cough Syrup

Morphine — Acetylation → Heroine

Heroine → Diacetylation of morphine

(Diacetyl Morphine)

Heroine → Smack

Smack → Produced from Heroine

- Brown Sugar
- Taken by Snorting & Injuction

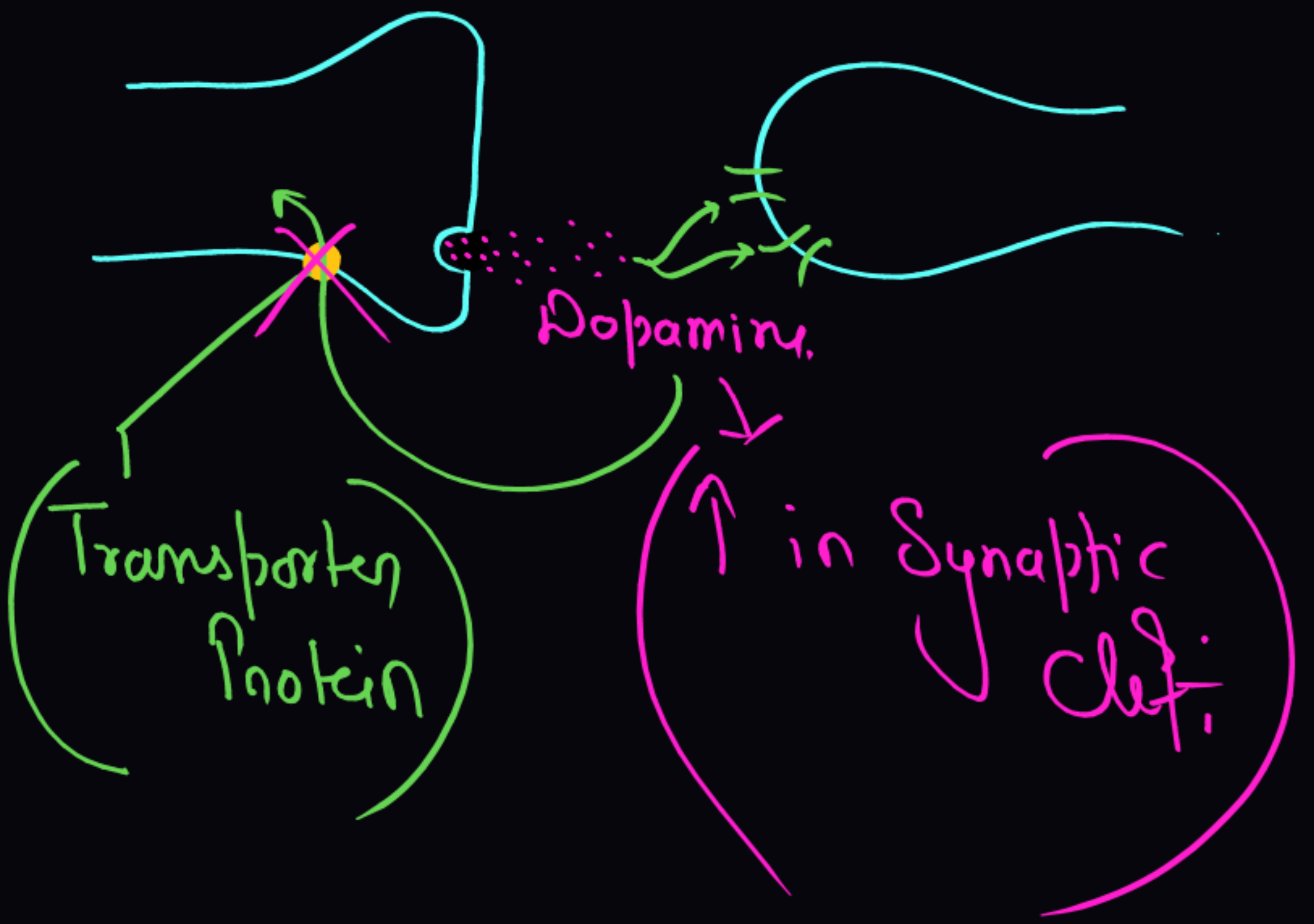
Smack:
- white Crystals
- Bitter & odourless

Stimulants

- → Cocaine ✓
- → Tobaco ✓
- → Amphitamine ✓

① Cocaine or Coke/Crack

- → Isolate from Coca plant (Erythroxylum Coca) [Native to South America]
- Taken by = Snorting
- → Euphoriant
- → Excessive dosage = Hallucination
- Stimulate - CNS - by interferes With transport of Dopamine



Dopamine
Transporter Protein
↑ in Synaptic Cleft.

Tobacco

→ Nicotine alkaloid tnt

Taken by Smoked, Chewed, Snuff

Stimulate Adrenal glands

↓ Release

[Adrenalin & Noradrenalin]

→ ↑ - Blood glucose level

↑ - Heart Rate

↑ - Breathing Rate

Associated with = Mouth Cancer

Smoking
- ↑ - CO in blood
- Lung Cancer

Amphetamine

- Synthetic Drugs
- Superman Drugs
- Anti sleep Drugs
- Included in Dope Test

1) Cannabinoids (Hallucinogenic)

* Receptors present in brain
* Isolate from ⇒ Plant **Cannabis Sativa**

eg- Marijuana → Dried flower (Delta-9 T.H.C)
- Bhang → Fresh leaves
- Ganja → Female inflorescence
- Charas or Hashish → Resinous Extract

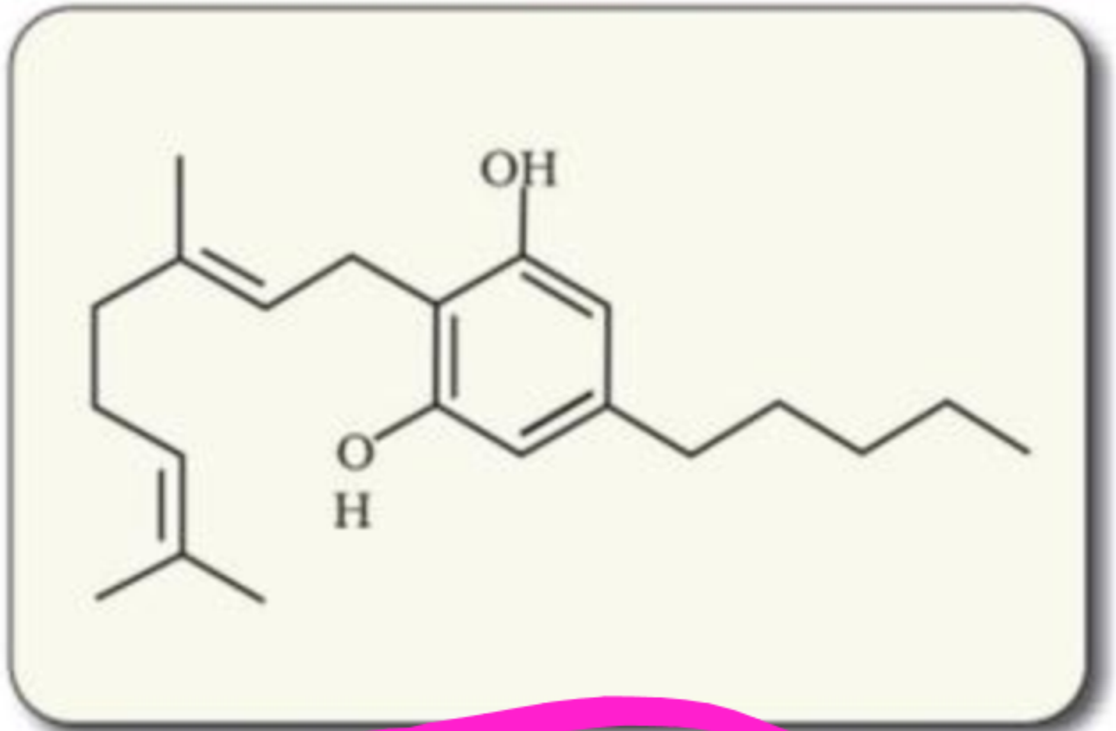


Figure 8. Skeletal structure of cannabinoid molecule



Figure 8.10 Leaves of *Cannabis sativa*

2) **L.S.D.** (Lysergic acid diethylamide)

Optain from ⇒ Ergot of fruting body of Fungus ⇒ Clavicaps purpura

3) Datura & Atropa-bellaDona



Atropa Belladonna



Figure 8.11 Flowering branch of *Datura*

Datura

Adolescence and Drug/Alcohol Abuse

- Adolescence means both ‘a period’ and ‘a process’ during which a child becomes mature in terms of his/her attitudes and beliefs for effective participation in society.
- The period between 12-18 years of age may be thought of as adolescence period. In other words, adolescence is a bridge linking childhood and adulthood.
- Adolescence is accompanied by several biological and behavioural changes. Adolescence, thus is a very vulnerable phase of mental and psychological development of an individual

Addiction and Dependence-

- Addiction is a psychological attachment to certain effects –such as euphoria and a temporary feeling of well-being – associated with drugs and alcohol.
- With repeated use of drugs, the tolerance level of the receptors present in our body increases. Consequently the receptors respond only to higher doses of drugs or alcohol leading to greater intake and addiction.
- However, it should be clearly borne in mind that use of these drugs even once, can be a fore-runner to addiction.

- Dependence is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drugs/alcohol is abruptly discontinued. This is characterized by anxiety, shakiness, nausea and sweating, which may be relieved when use is resumed again.
- In some cases, withdrawal symptoms can be severe and even life threatening and the person may need medical supervision.

Effects of Drug/Alcohol Abuse

- Excessive doses of drugs may lead to coma and death due to respiratory failure, heart failure or cerebral hemorrhage.
- A combination of drugs or their intake along with alcohol generally results in overdosing and even deaths.
- The most common warning signs of drug and alcohol abuse among youth include drop in academic performance, unexplained absence from school/college, lack of interest in personal hygiene, withdrawal, isolation, depression, fatigue, aggressive and rebellious behaviour, deteriorating relationships with family and friends, loss of interest in hobbies, change in sleeping and eating habits, fluctuations in weight, appetite, etc.

- The chronic use of drugs and alcohol damages nervous system and liver (cirrhosis).
- The use of drugs and alcohol during pregnancy is also known to adversely affect the foetus.
- Another misuse of drugs is what certain sports persons do to enhance their performance. They (mis)use narcotic analgesics, anabolic steroids, diuretics and certain hormones in sports to increase muscle strength and bulk and to promote aggressiveness and as a result increase athletic performance.

- The side-effects of the use of anabolic steroids in females include masculinisation (features like males), increased aggressiveness, mood swings, depression, abnormal menstrual cycles, excessive hair growth on the face and body, enlargement of clitoris, deepening of voice.
- In males it includes acne, increased aggressiveness, mood swings, depression, reduction of size of the testicles, decreased sperm production, potential for kidney and liver dysfunction, breast enlargement, enlargement of the prostate gland. These effects may be permanent with prolonged use.
- In the adolescent male or female, severe facial and body acne, and premature closure of the growth centres of the long bones may result in stunted growth.

Prevention and Control

Some of the measures mentioned here would be particularly useful for prevention and control of alcohol and drugs abuse among adolescents-

1. **Avoid undue peer pressure**
2. **Education and counselling**
3. **Seeking help from parents and peers**
4. **Looking for danger signs**
5. **Seeking professional and medical help**

THANK YOU !!

MANTHAN NEET

BIOTECHNOLOGY AND ITS APPLICATIONS

LECTURE - 1

ZOOLOGY



MD SIR

TODAY'S GOAL

12.1 *Biotechnological Applications in Agriculture*

12.2 *Biotechnological Applications in Medicine*

12.3 *Transgenic Animals*

12.4 *Ethical Issues*

Biotechnological Applications in

1. Agriculture
2. Medicine

(1) BIOTECHNOLOGICAL APPLICATIONS IN AGRICULTURE :-

Let us take a look at the three options that can be thought for increasing food production

(i) Agro-chemical based agriculture;
(ii) Organic agriculture; and
(iii) Genetically engineered crop-based agriculture.

Agro-chemical based agriculture:
- Chemical Fertilizer
- Fungicides
- Herbicides
- Insecticides

Organic agriculture:
- Biofertilizer
- Biopesticides
- Biocontrol

Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called Genetically Modified Organisms (GMO). GM plants have been useful in many ways. Genetic modification has:

(i) Made crops more tolerant to abiotic stresses (cold drought, salt, heat).

(ii) reduced reliance on chemical pesticides (pest-resistant crops).

(iii) helped to reduce post harvest losses.

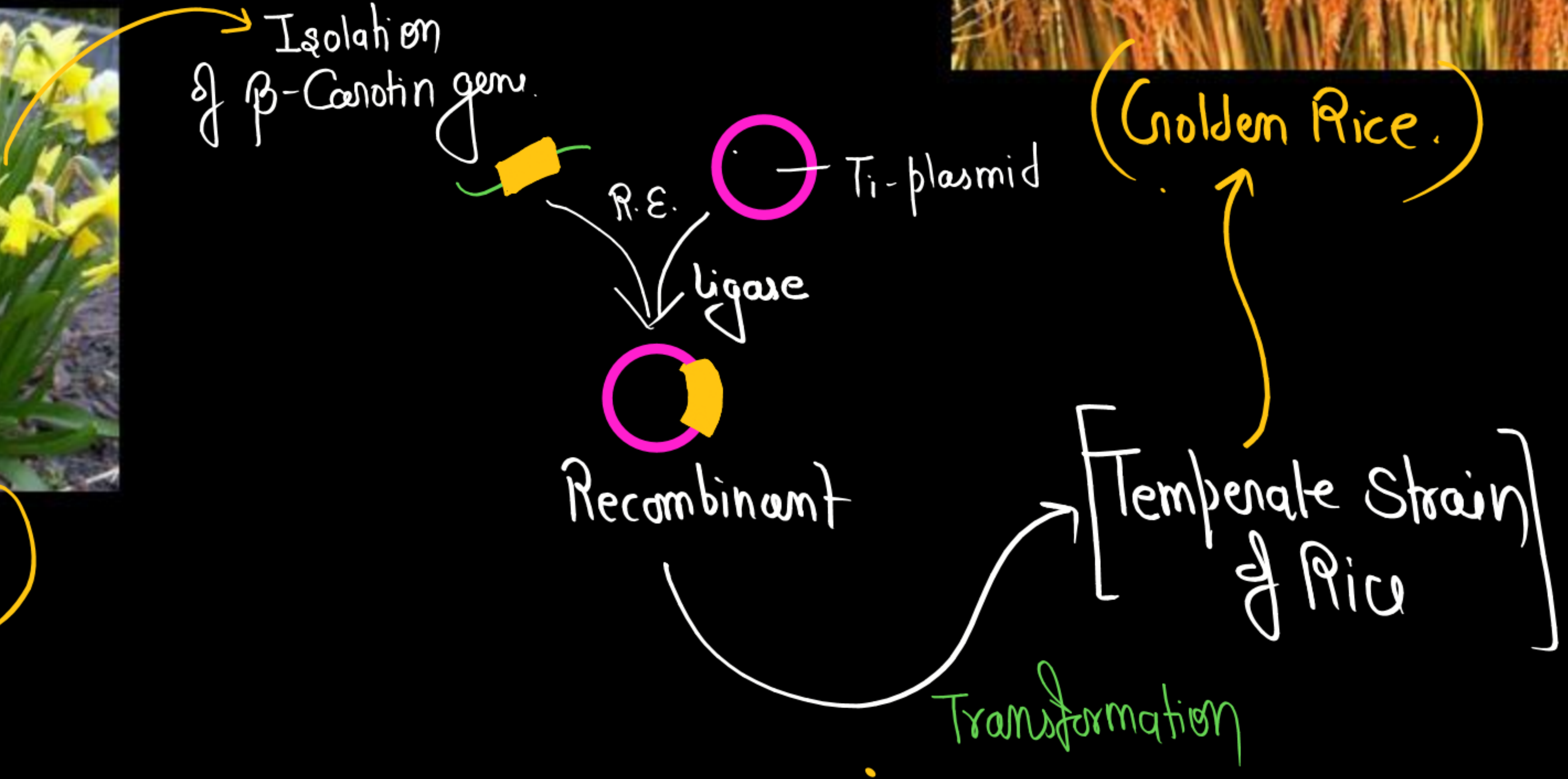
(iv) Increased efficiency of mineral usage by plants (this prevents early exhaustion of fertility of soil).

(v) enhanced nutritional value of food, e.g., golden rice, i.e., Vitamin 'A'

Golden rice :- (Oryza sativa)

- Transgenic variety
- Contain – β carotene (Pro-Vit.-A)





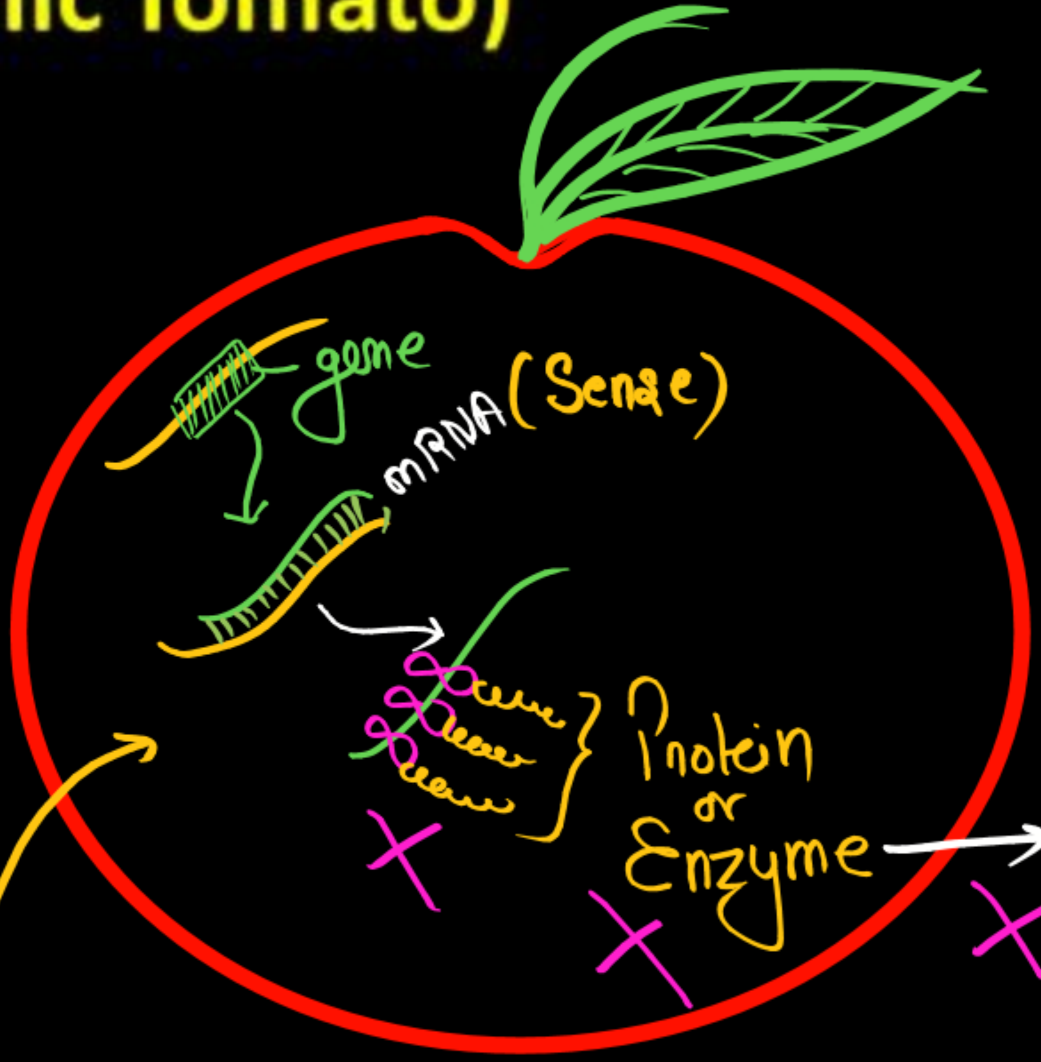


Flaver Savr (Transgenic Tomato)

RNA-i

or

Antisense R.NA + Complementary mRNA of Sense R.N.A



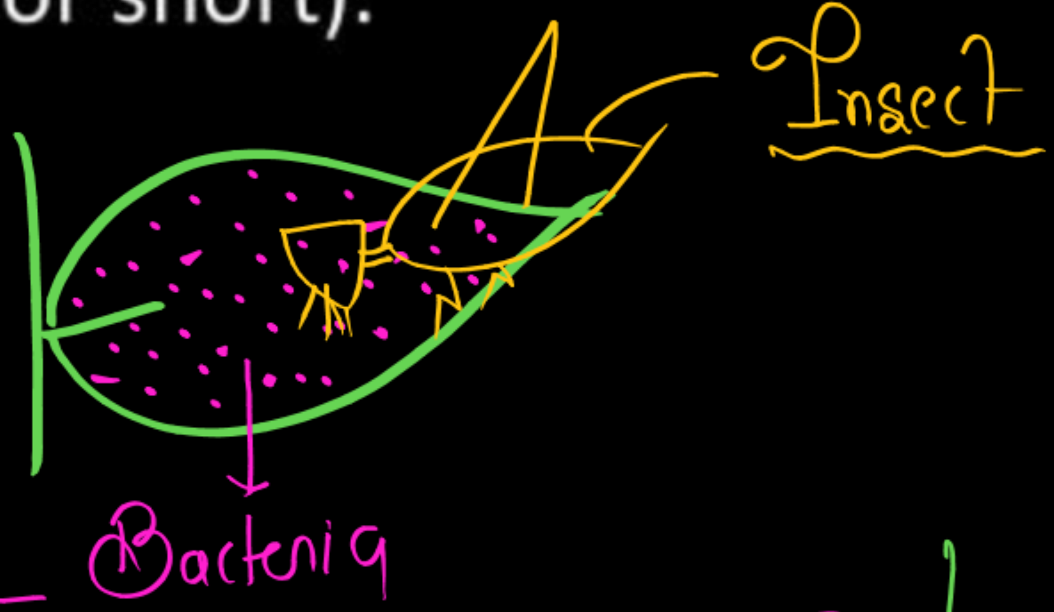
Polygalacturonase

(It is Responsible for Softning of Tomato)

Formation of ds R.N.A → Stop Translation

Bt toxin

Bt toxin is produced by a bacterium called Bacillus thuringiensis (Bt for short).



[Bacillus thuringiensis] + (Contain inactive Endotoxin)

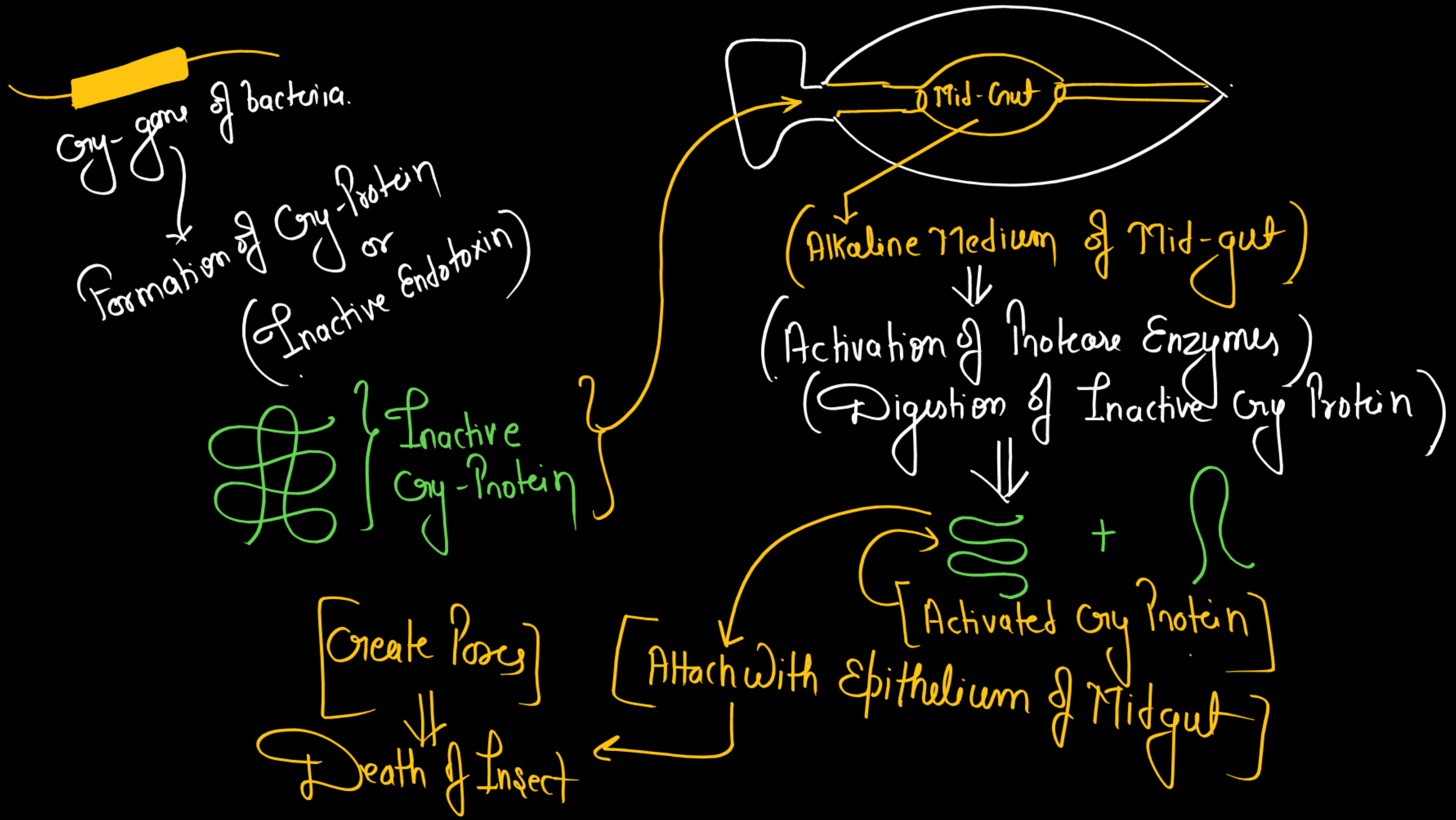
Enter in gut of Insect

↓

Activate in gut & Create Pores in gut.

⇓

(Death of Insect)



Cry-gene of bacteria.
Formation of Cry-Protein or (Inactive Endotoxin)
Inactive Cry-Protein
Mid-Gut
(Alkaline Medium of Mid-gut)
(Activation of Protease Enzymes)
(Digestion of Inactive Cry Protein)
+
[Activated Cry Protein]
[Attach with Epithelium of Midgut]
[Create Pores]
Death of Insect

Bt toxin gene has been cloned from the bacteria and been expressed in plants to provide resistance to insects without the need for insecticides; in effect created a bio-pesticide. Examples are Bt cotton, Bt corn, rice, tomato, potato and soyabean etc.

Bt Cotton: Some strains of Bacillus thuringiensis produce proteins that kill certain insects such as -

- Lepidopterans - tobacco budworm, armyworm, Cotton ballworm, Corn borer.
- Coleopterans - beetles
- Dipterans - flies, mosquitoes

- B. Thuringiensis forms protein crystals during a particular phase of their growth. These crystals contain a toxic insecticidal protein.
- Actually, the Bt toxin protein exist as inactive protoxins but once an insect ingest the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilise the crystals The activated toxin binds to the surface of midgut epithelial cells and create pores that cause cell swelling and lysis and eventually cause death of the insect.

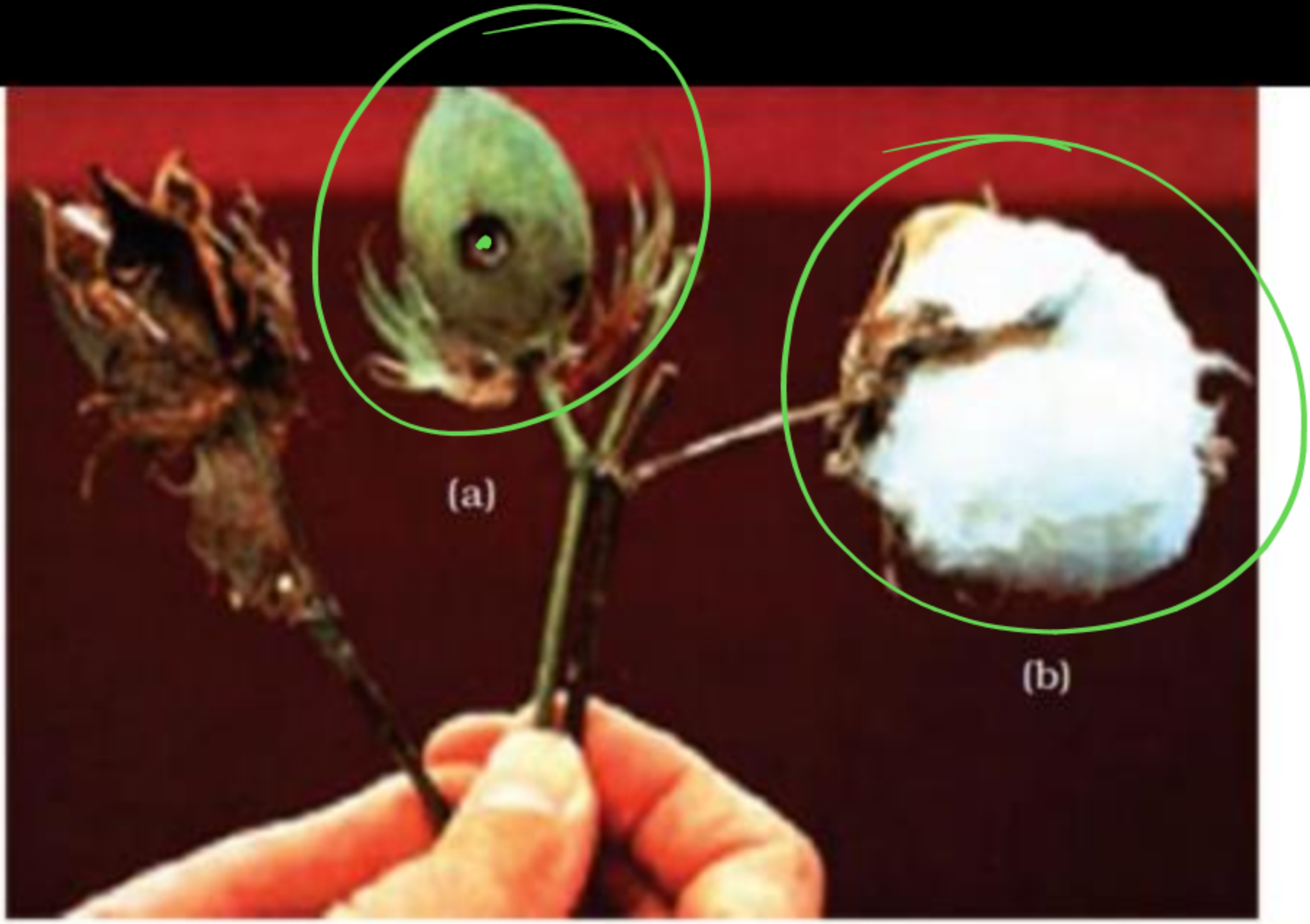


Figure 12.1 Cotton boll: (a) destroyed by bollworms; (b) a fully mature cotton boll

- Specific Bt toxin genes were isolated from Bacillus thuringiensis and incorporated into the several crop plants such as cotton.
- The toxin is coded by a gene cry.
- For example, -

Cry I Ab -	Corn borer
Cry I Ac and Cry II Ab -	Cotton bollworms

Crystalline protein synthesized by *Bacillusthuringiensis* is activated by

(1) Acidic conditions of bacterial food vacuole
(2) Alkaline pH of bacterial food vacuole
(3) Acidic pH in insect fore-gut
(4) Alkaline pH in insect mid-gut

4

Bt toxin kills the insect by

(1) Blocking mitochondrial respiration
(2) Blocking transfer of nerve impulse
(3) Creating pores in body surface
(4) Creating pores in mid-gut epithelial cell ✓ (4)

The protein products of the following Bt toxin genes Cryl Ac and Cry II Ab are responsible for controlling.

(1) Bollworm
(2) Roundworm
(3) Moth
(4) Fruit fly

A transgenic rice (Golden rice) has been developed for increased content of

(1) Vitamin A
(2) Vitamin B
(3) Vitamin C
(4) Vitamin D

1

What is true about Bt toxin?

(1)The concerned Bacillus has antitoxins
(2) The inactive protoxin gets converted into active form in the insect gut
(3) Bt protein exists as active toxin in the Bacillus
(4) The activated toxin enters the ovaries of the pest to sterilise it and thus prevent its multiplication

(2)

THANK YOU !!

MANTHAN NEET

BIOTECHNOLOGY AND ITS APPLICATIONS

LECTURE - 2

ZOOLOGY

SANKALP NEET VEDANTU



MD SIR

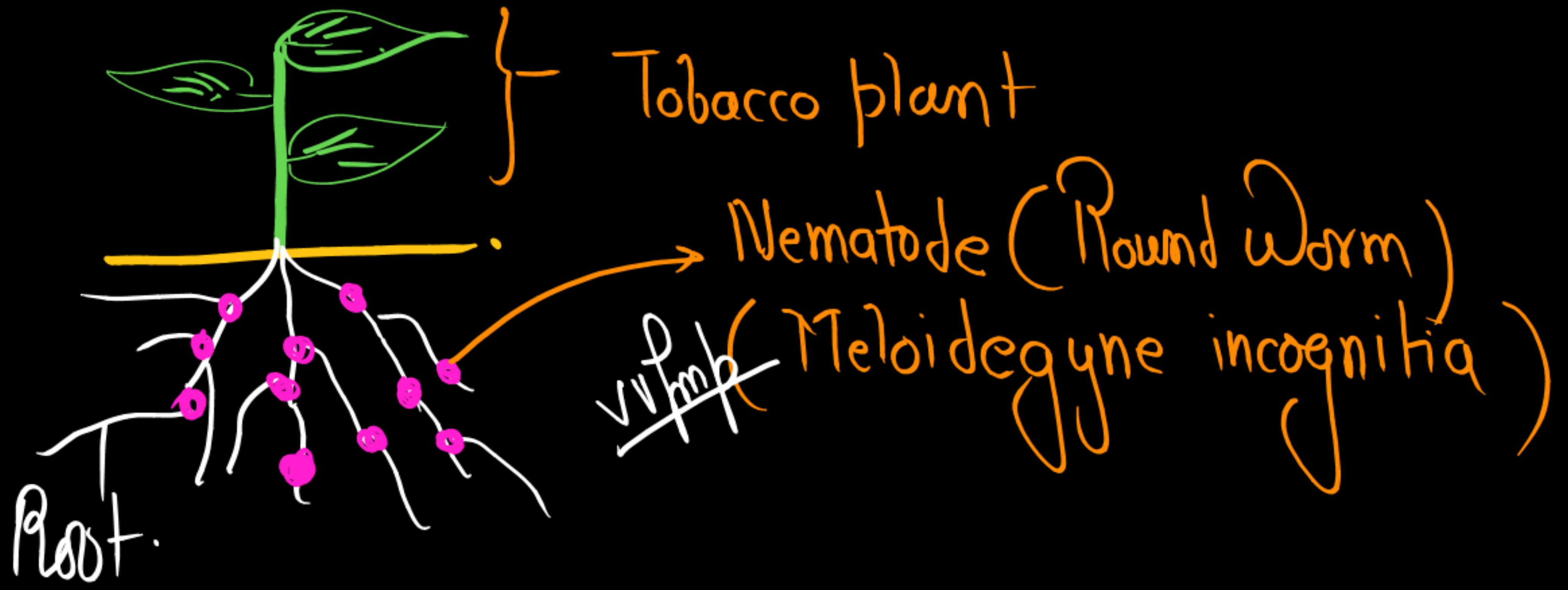
TODAY'S GOAL

③ - ④

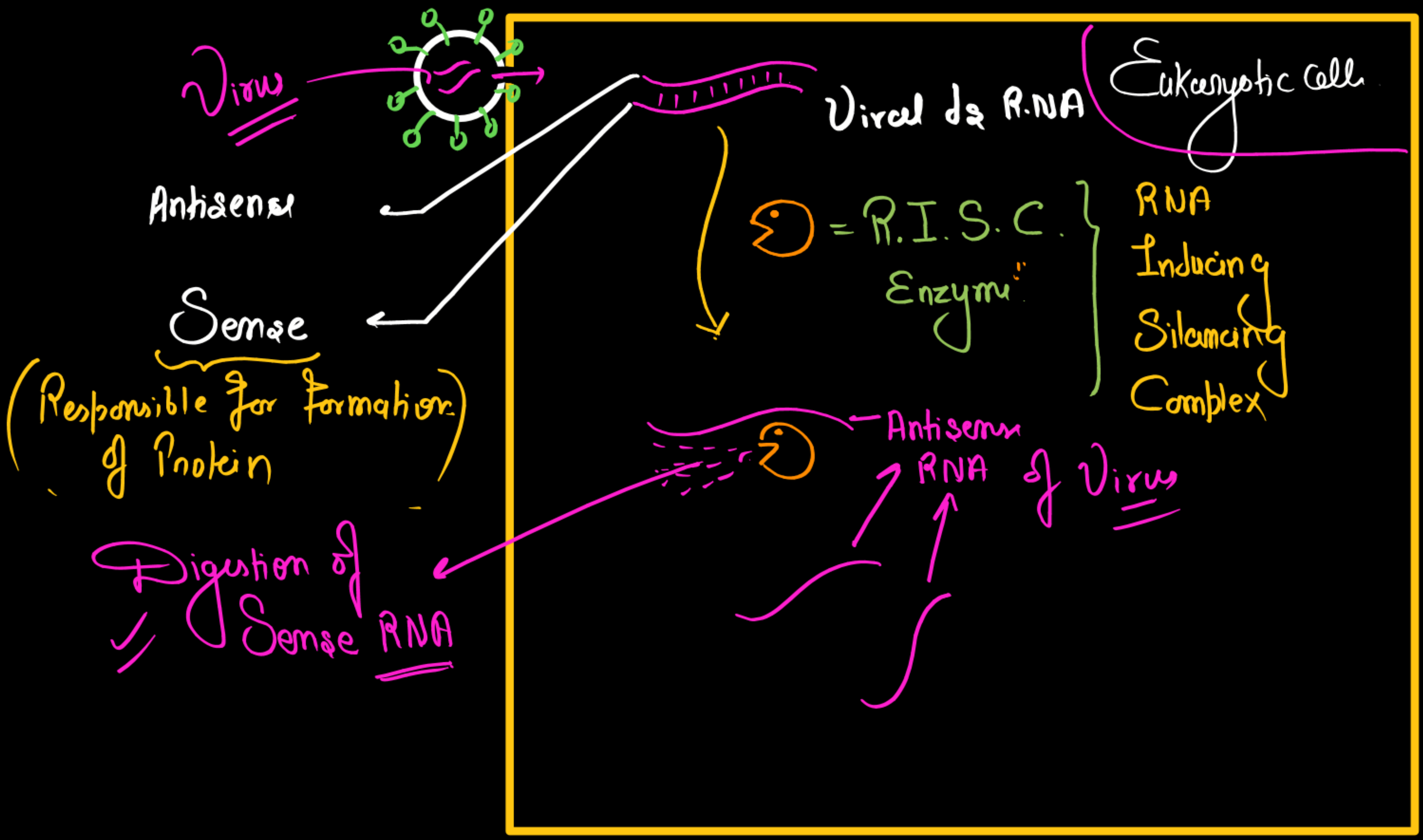
RNA-i

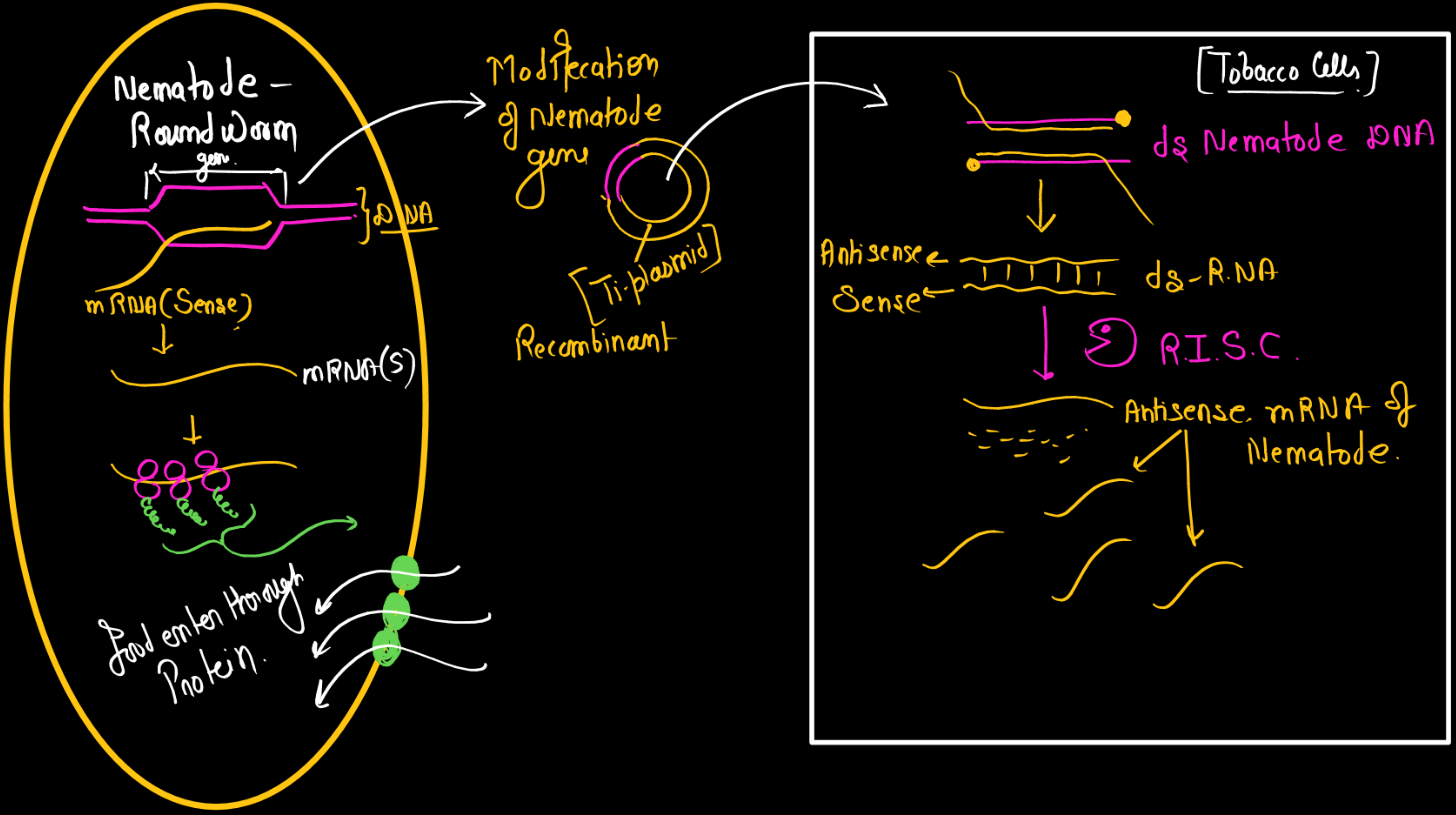
Pest Resistant Plants / RNA interference (RNAi) -

- Several nematodes parasitise a wide variety of plants and animals including human beings.
- A nematode *Meloidegyne incognitia* infects the roots of tobacco plants and causes a great reduction in yield.
- A novel strategy was adopted to prevent this infestation which was based on the process of RNA interference (RNAi).

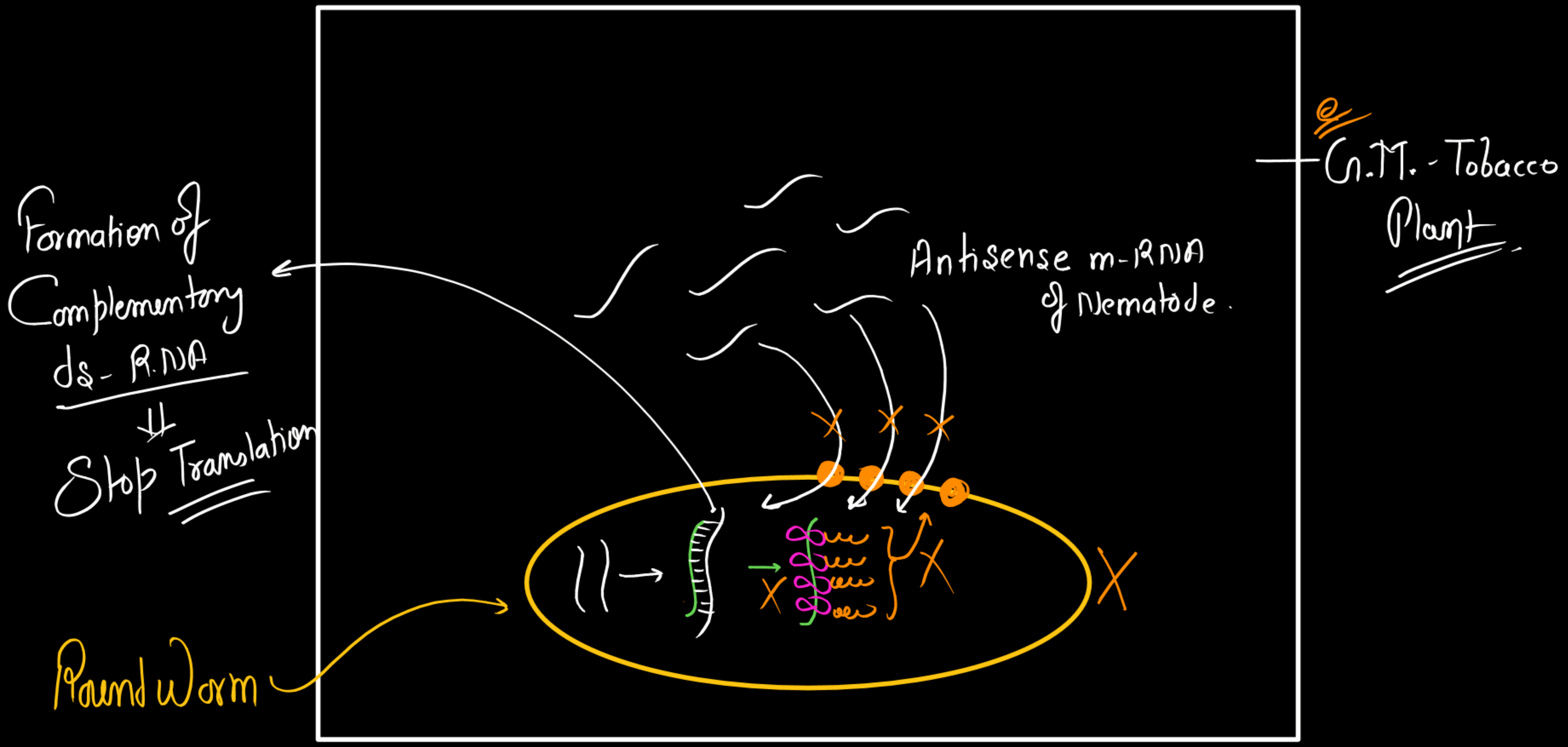


- RNAi takes place in all eukaryotic organisms as a method of cellular defense.
- This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA (silencing).


Virus
Viral ds RNA
Eukaryotic cell
Antisense
Sense
(Responsible for Formation of Protein)
= R.I.S.C. Enzyme
RNA Inducing Silencing Complex
Antisense RNA of Virus
Digestion of Sense RNA



Nematode -
Round Worm
gene
DNA
mRNA(Sense)
mRNA(S)
Food enter through Protein.
Modification of Nematode gene
Ti-plasmid
Recombinant
[Tobacco Cells]
ds Nematode DNA
Antisense
Sense
ds-R.NA
R.I.S.C.
Antisense mRNA of Nematode.


Formation of Complementary ds-RNA
⇓
Stop Translation
Antisense m-RNA of Nematode
G.M. - Tobacco Plant
Round Worm

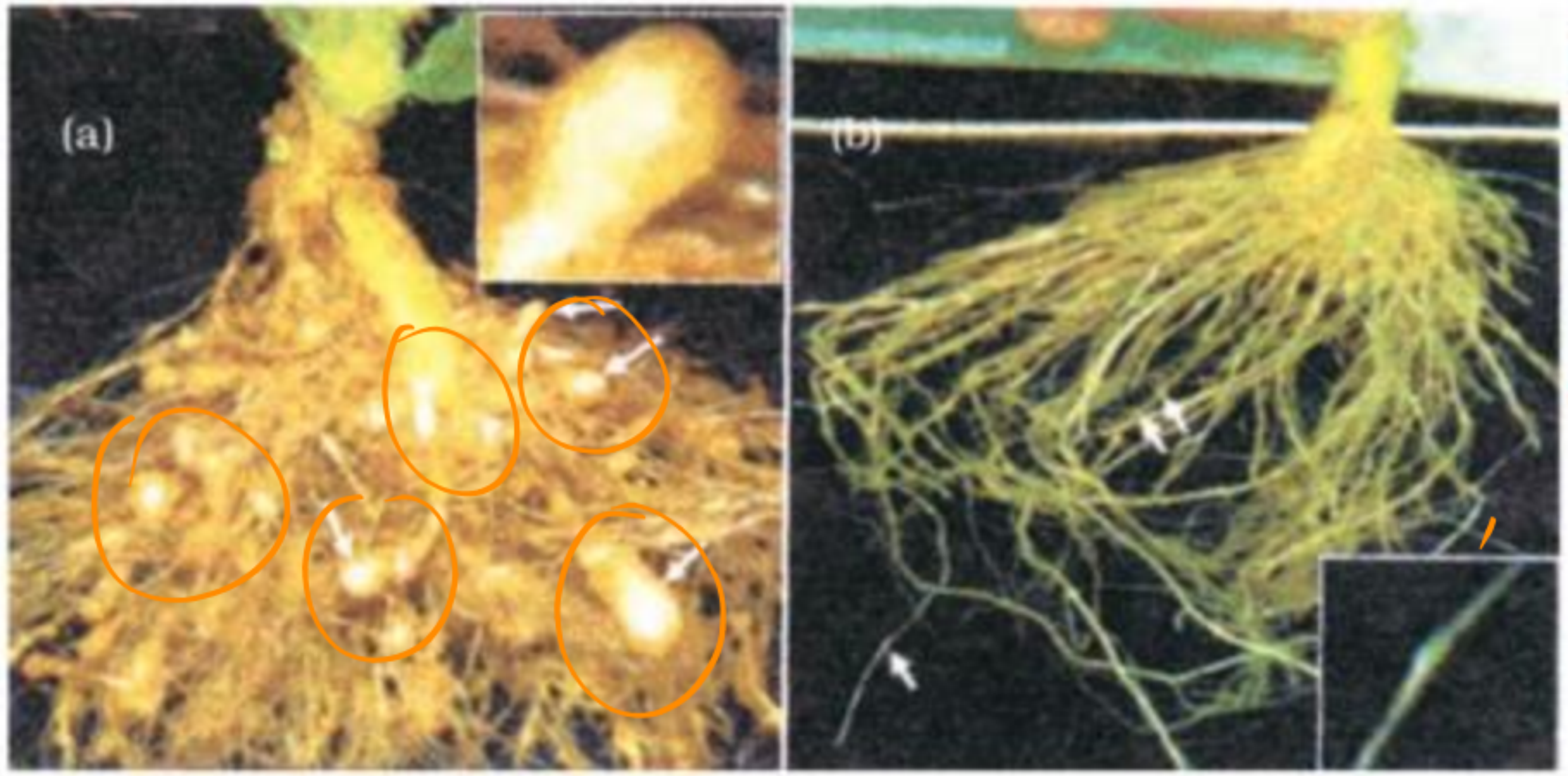
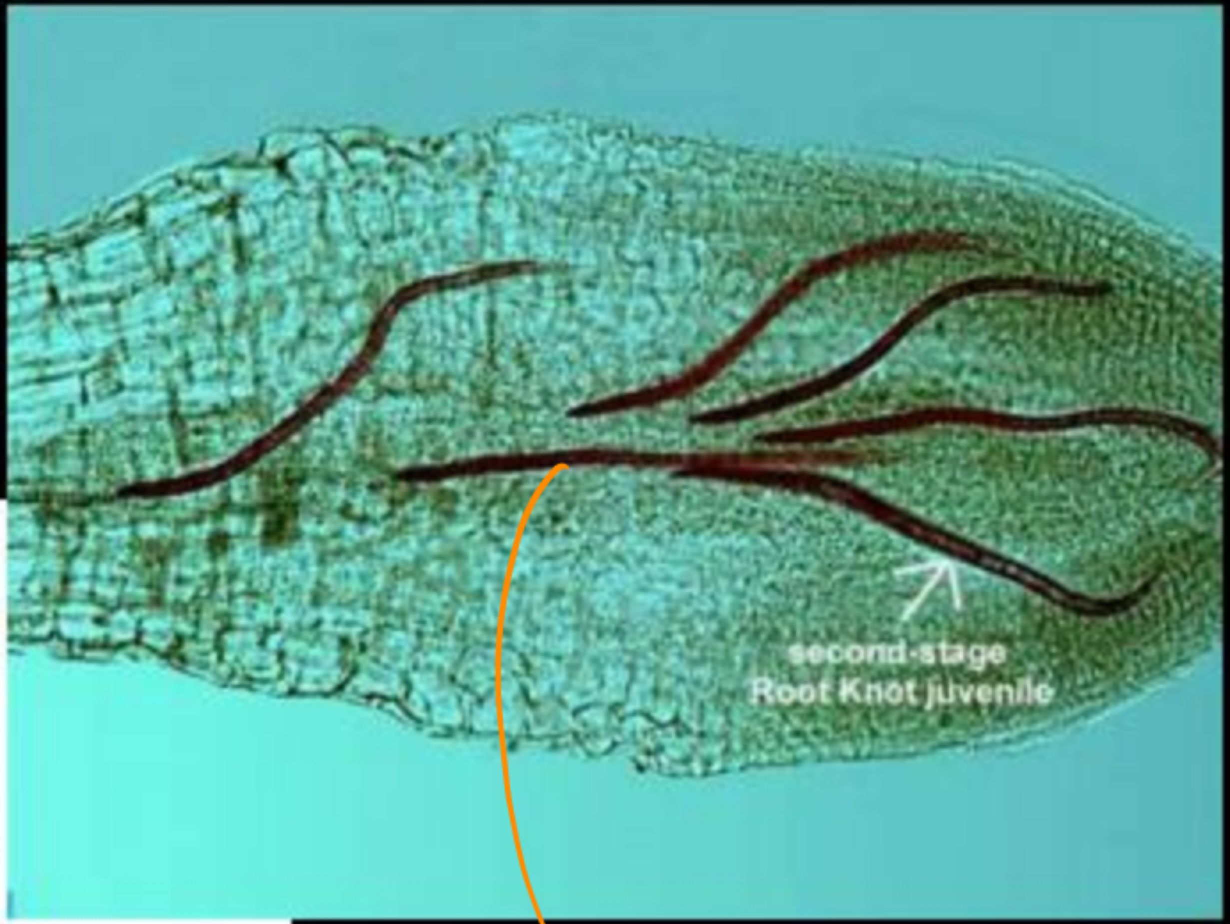


Figure 12.2 Host plant-generated dsRNA triggers protection against nematode infestation: (a) Roots of a typical control plants; (b) transgenic plant roots 5 days after deliberate infection of nematode but protected through novel mechanism.



Nematode

BIOTECHNOLOGICAL APPLICATIONS IN MEDICINE

- At present, about 30 recombinant therapeutics have been approved for human-use the world over.
- In India, 12 of these are presently being marketed.

(1) Genetically Engineered Insulin

- Insulin used for diabetes was earlier extracted from pancreas of slaughtered cattle and pigs.
- Insulin from an animal source, though caused some patients to develop allergy or other types of reactions to the foreign protein.
- Insulin consists of two short polypeptide chains: chain A and chain B, that are linked together by disulphide bridges.
- In mammals, including humans, insulin is synthesised as a pro-hormone (like a pro-enzyme, the pro-hormone also needs to be processed before it becomes a fully mature and functional hormone) which contains an extra stretch called the C peptide. This C peptide is not present in the mature insulin and is removed during maturation into insulin.
- The main challenge for production of insulin using rDNA techniques was getting insulin assembled into a mature form.

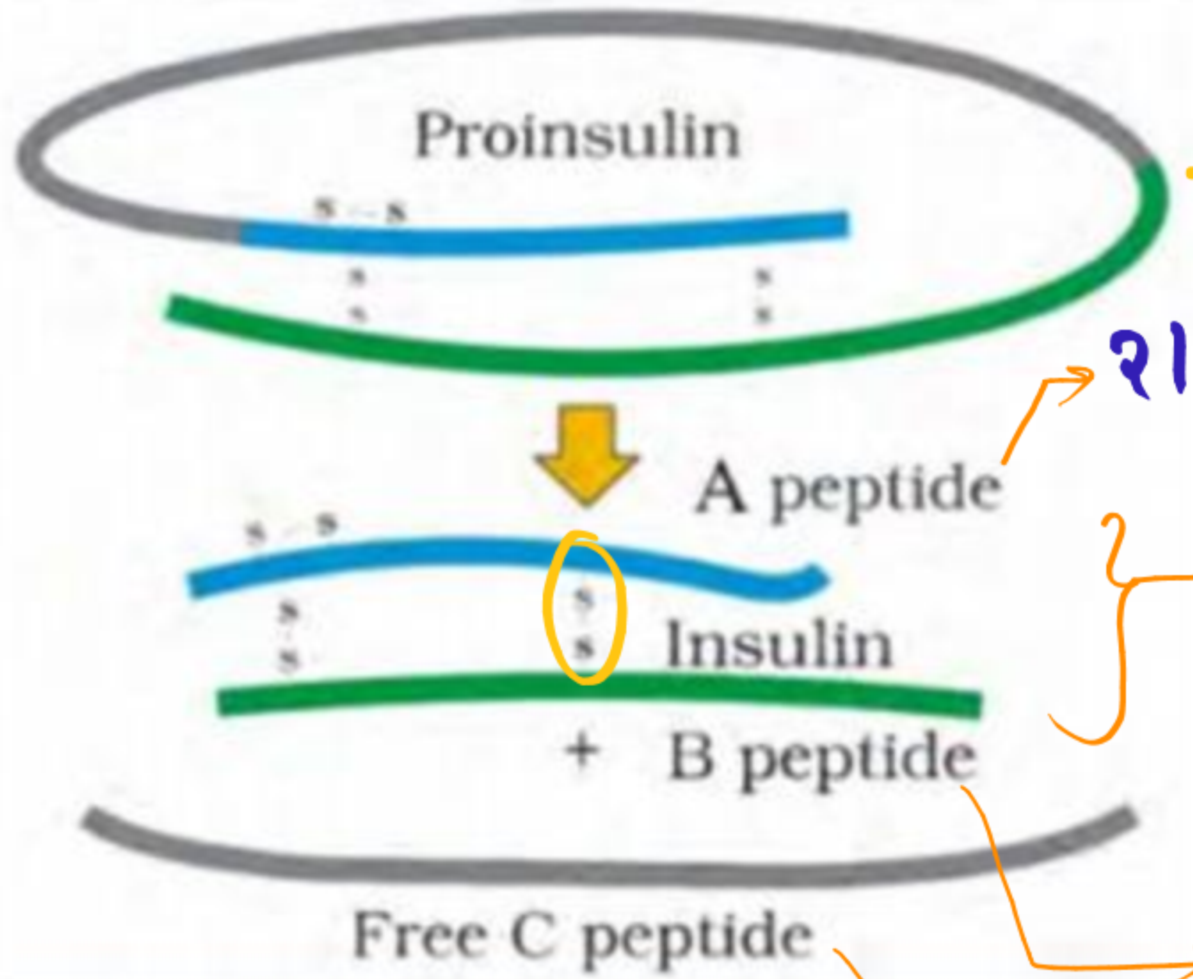


Figure 12.3 Maturation of pro-insulin into insulin (simplified)

Pro insulin (Inactive) = 84 amino acid.

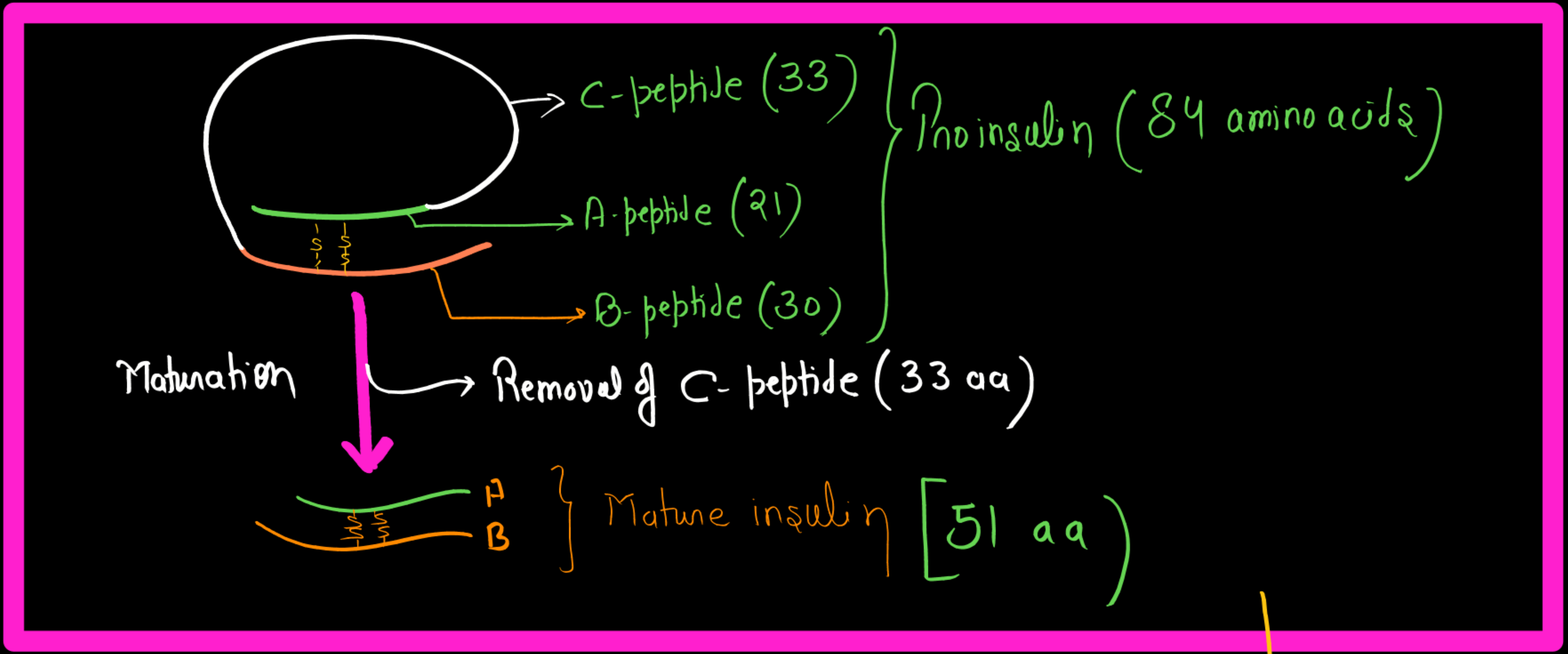
Removal of C-peptide (33 a.a.)

Mature insulin (Active) = 51 aminoacids

A peptide → 21 amino acids

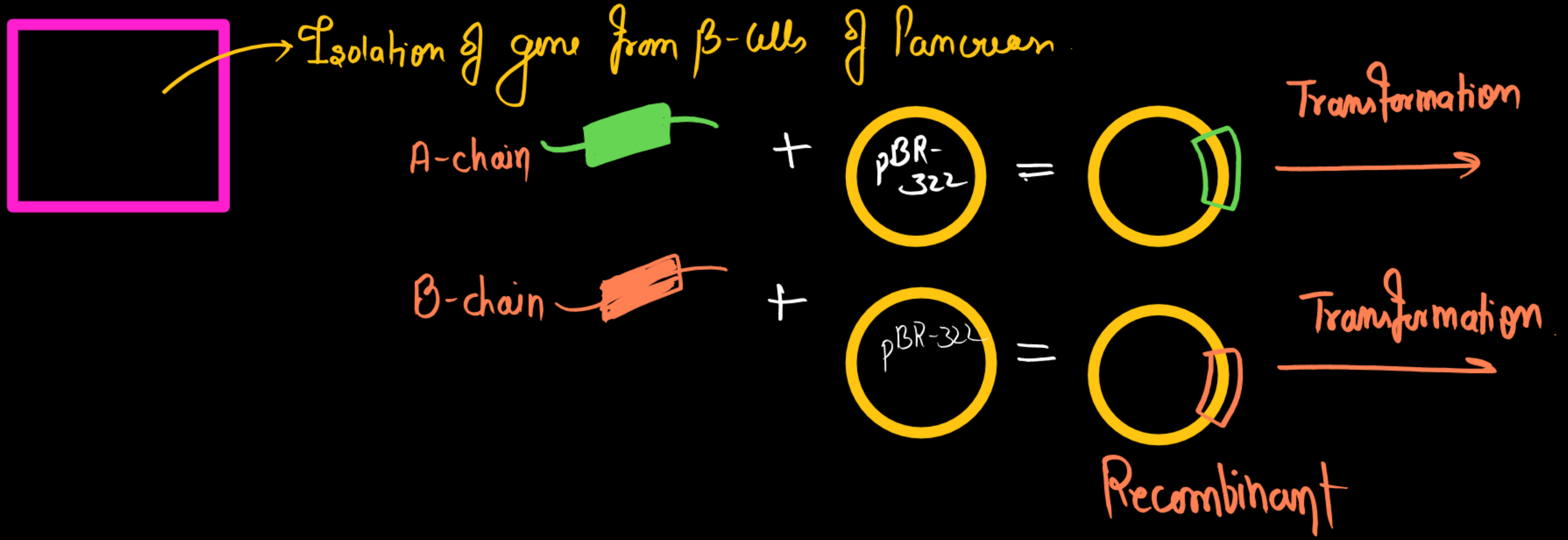
B peptide → 30 amino acids

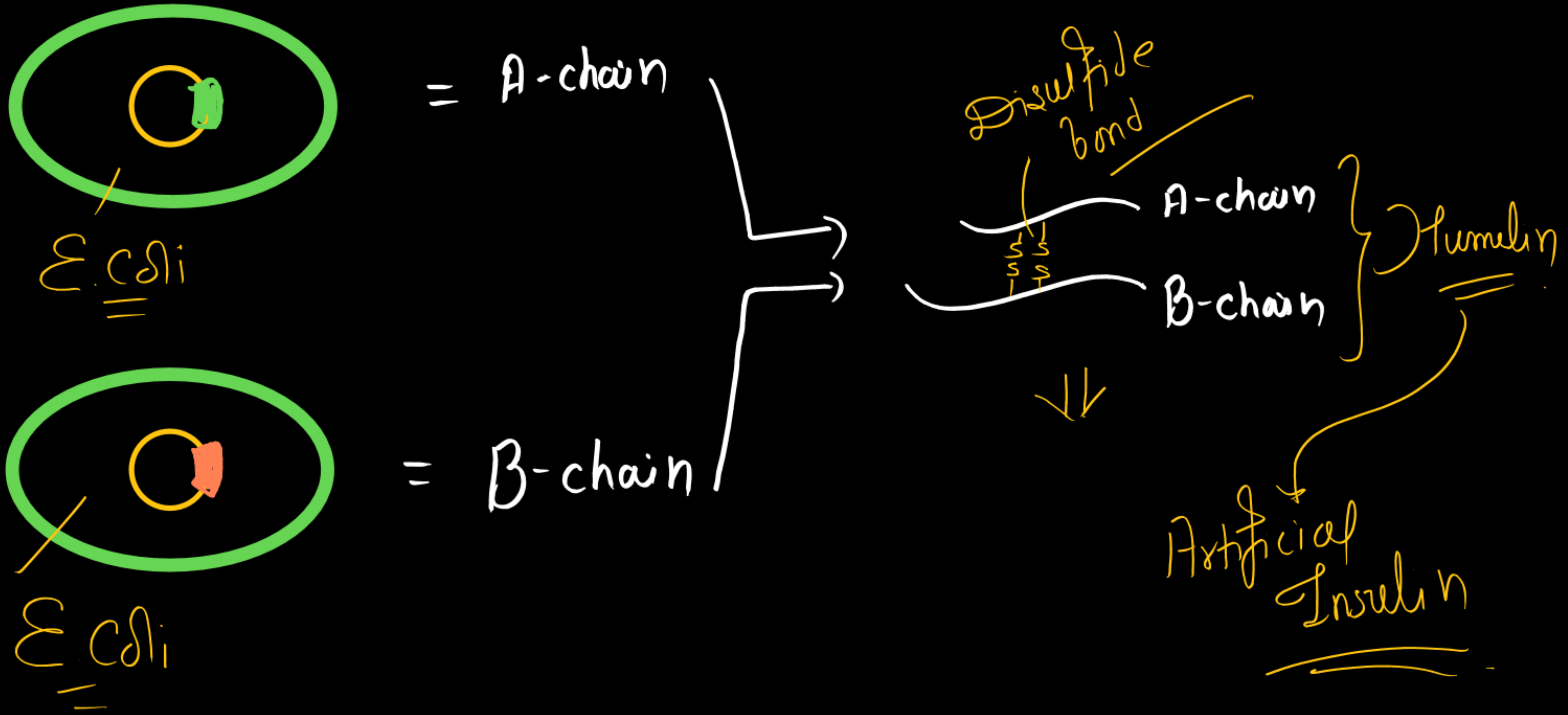
Free C peptide → 33 amino acids



(B-Cells of Pancreas)

In 1983, Eli Lilly an American company prepared two DNA sequences corresponding to A and B, chains of human insulin and introduced them in plasmids of *E. coli* to produce insulin chains. Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form human insulin.

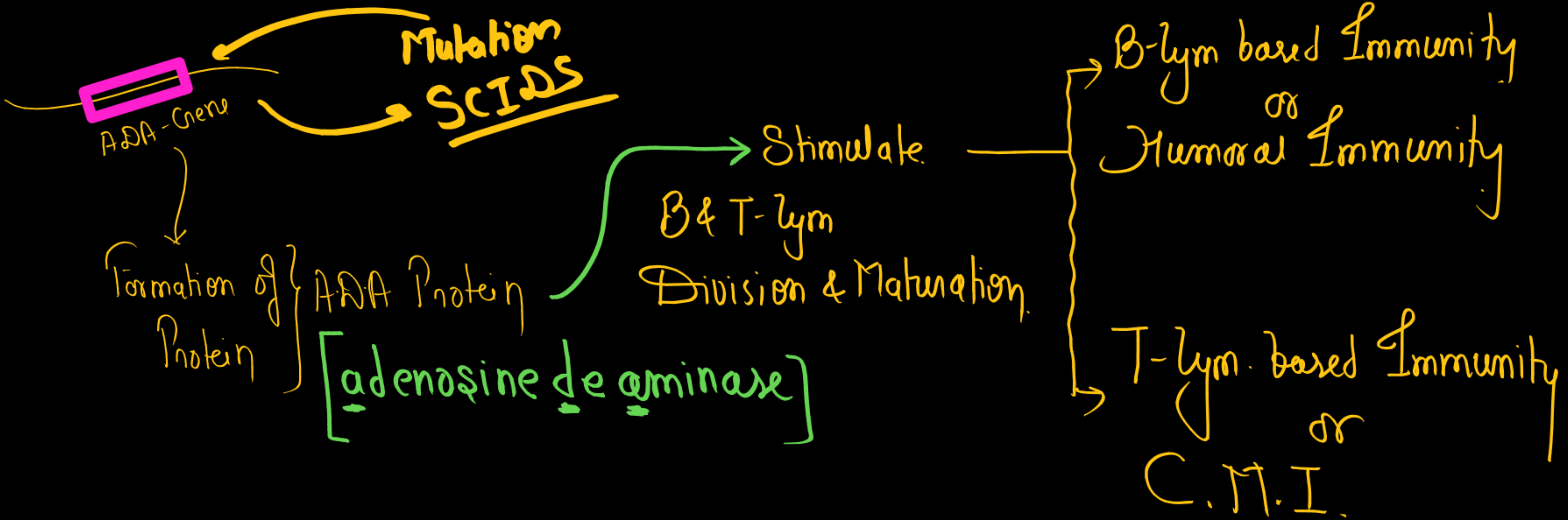




= A-chain
E. coli
= B-chain
E. coli
Disulfide bond
A-chain
B-chain
Humulin
Artificial Insulin

Gene Therapy

- The first clinical gene therapy was given in 1990 to a 4-year old girl with adenosine deaminase (ADA) deficiency.
- This enzyme is crucial for the immune system to function.



- In some children ADA deficiency can be cured by -

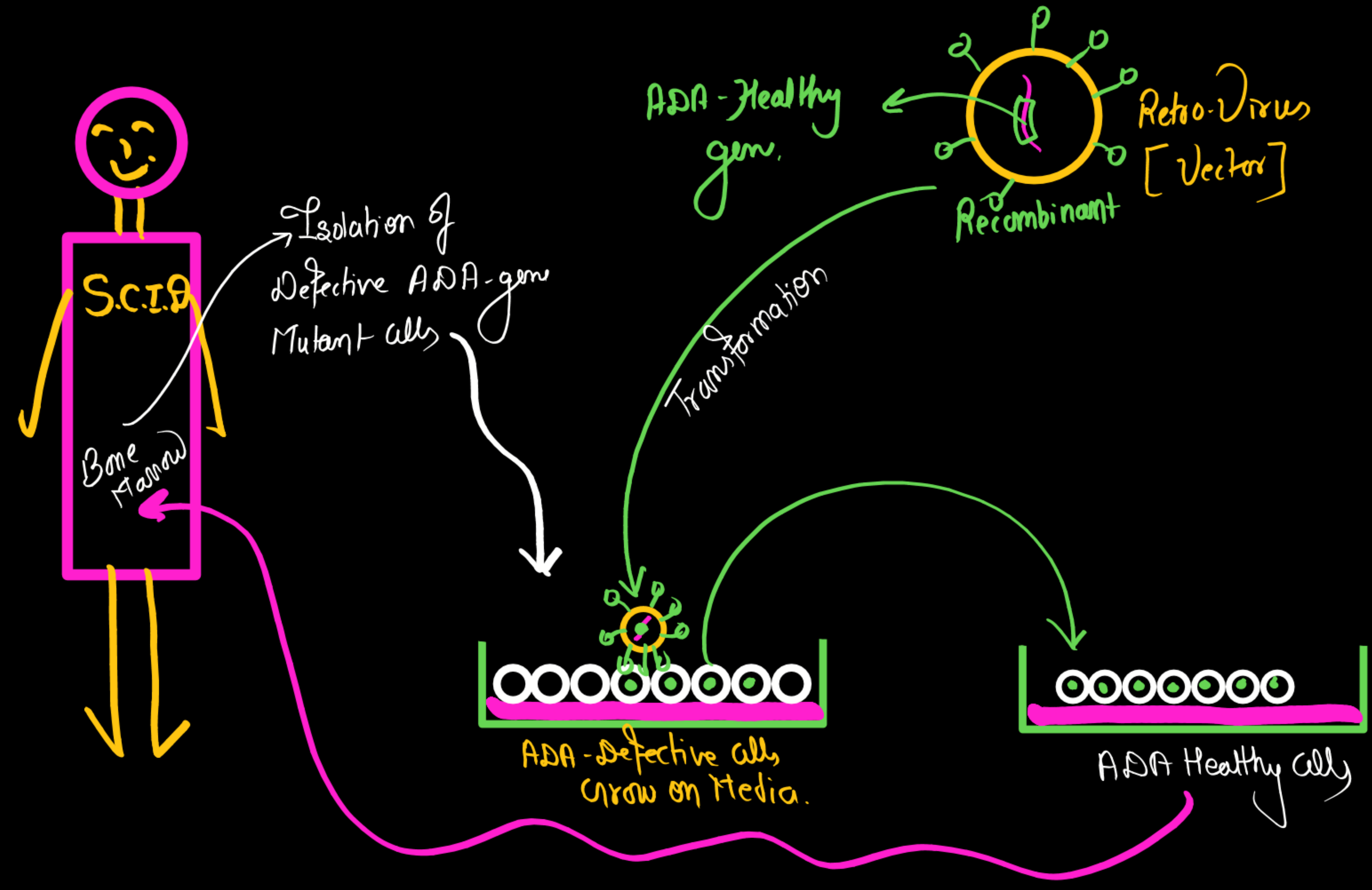
A. Bone marrow transplantation

B. Enzyme replacement therapy, in which functional ADA is given to the patient by injection.

- But the problem with both of these approaches that they are not completely curative.

Method of Gene therapy -

- As a first step towards gene therapy, lymphocytes from the blood of the patient are grown in a culture outside the body.
- A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient.
- However, as these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes.
- However, if the gene isolate from marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.



S.C.I.D
Bone Marrow
Isolation of Defective ADA-gene Mutant cells
ADA-Healthy gene.
Retro-Virus [Vector]
Recombinant
Transformation
ADA-Defective cells Grow on Media.
ADA Healthy cells

Methods of producing microbe and pest resistant plants include

(1)RNAi
(2)Use of Bt toxin
(3)Gene therapy
(4)Both (1) & (2)

How many recombinant therapeutics have been approved for human use in world over?

(1) 12
(2) 30
(3) 42
(4) 27

Tobacco plants resistant to a nematode have been developed by the introduction of DNA that produced in the host cells

(1) Both sense and anti-sense RNA
(2) A particular hormone
(3) An antifeedant
(4) A toxic protein

Which of the following peptide is not present in mature insulin?

(1) A
(2) B
(3) C
(4) Both A & B

Humulin was produced by

(1) Introducing sequence of human proinsulin in *E. coli*

(2) Introducing sequence of A and B chains of human insulin in single *E. coli*

(3) Introducing sequence of A and B chains of human insulin in separate *E.coli*

(4) Introduction insulin gene in *E.coli* using pUC18 vector

Human insulin is being commercially produced from a transgenic species of

(1) *Saccharomyces* (2) *E.coli*

(3) *Mycobacterium* (4) *Agrobacterium*

The main challenge for production of insulin using rDNA techniques was getting insulin into matured form using __________ bond

(1) Hydrogen
(2) Peptide
(3) Ionic
(4) Disulphide

The importance of RISC in RNA interference technique is that it

(1) Silences the nematode

(2) Causes unwinding of dsRNA

(3) Causes degradation of m-RNA of parasite

(4) Blocks translation of host m-RNA

Which kind of therapy was given in 1990 to a four year old girl with adenosine deaminase (ADA) deficiency? [NEET Phase II-2016]

(1) Gene therapy
(2) Chemotherapy
(3) Immunotherapy
(4) Radiation therapy

All of the following techniques can help in early detection of disease except –

(1) Recombinant DNA technology (RDT)
(2) Gene therapy
(3) Polymerase Chain Reaction (PCR)
(4) Enzyme Linked Immuno Sorbant Assay (ELISA)

Permanent cure for ADA (Adenosine Deaminase) deficiency is –

(1) Blood transfusion
(2) Enzyme replacement therapy.
(3) Introduction of gene producing ADA in early embryo.
(4) Bone marrow transplantation.

A probe is allowed to hybridize with its complimentary DNA in a clone of cells and is later on detected by autoradiography.”
Above step is the part of –

(1) Recombinant DNA technology
(2) Polymerase chain reaction
(3) RNA interference
(4) Gene therapy

Enzyme used in ELISA test is

(1) Endonuclease
(2) Ligase
(3) Peroxidase
(4) Polymerase

Repeated transfusions of genetically modified cells are required in SCID patients and in enzyme replacement therapy because

(1) Transfused cells have a limited life span

(2) Introduced gene has been mutated

(3) The enzyme required is degraded after 20 days of transfusion

(4) Both (1) & (3)

The genetic defect-adenosine deaminase (ADA) deficiency may be cured permanently by

(1) Enzyme replacement therapy

(2) Periodic infusion of genetically engineered lymphocytes having functional ADA cDNA

(3) Administering adenosine deaminase activators

(4) Introducing bone marrow cells producing ADA into cells at early embryonic stages

THANK YOU !!

MANTHAN NEET

BIOTECHNOLOGY AND ITS APPLICATIONS

LECTURE - 3

ZOOLOGY



MD SIR

TODAY'S GOAL

12.1 *Biotechnological Applications in Agriculture*

12.2 *Biotechnological Applications in Medicine*

12.3 *Transgenic Animals*

12.4 *Ethical Issues*

Molecular Diagnosis

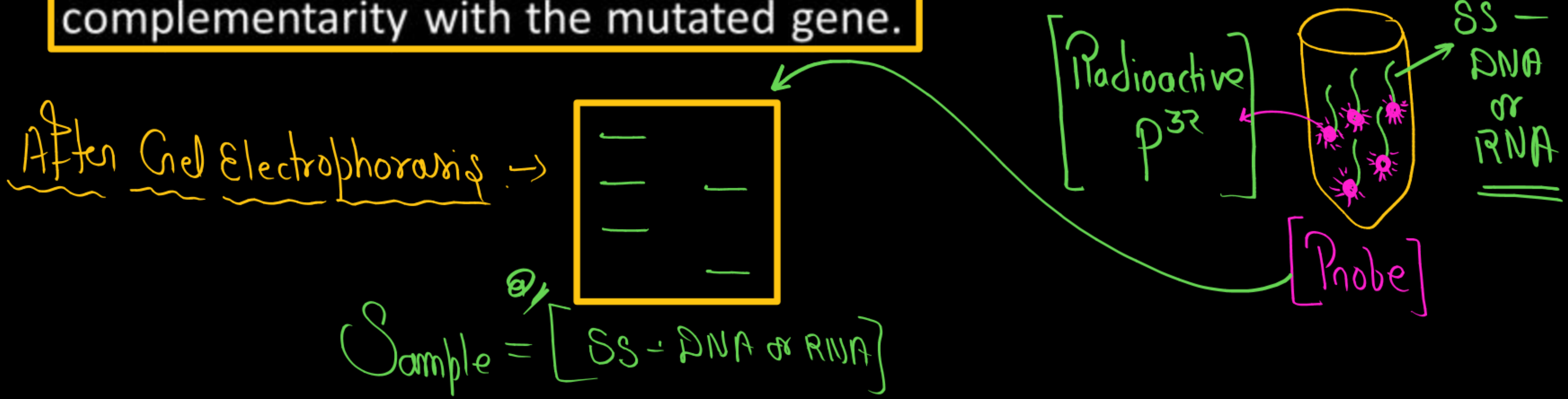
Recombinant DNA technology, Polymerase Chain Reaction (PCR) and Enzyme Linked Immuno-sorbent Assay (ELISA) are some of the techniques that serve the purpose of early diagnosis.

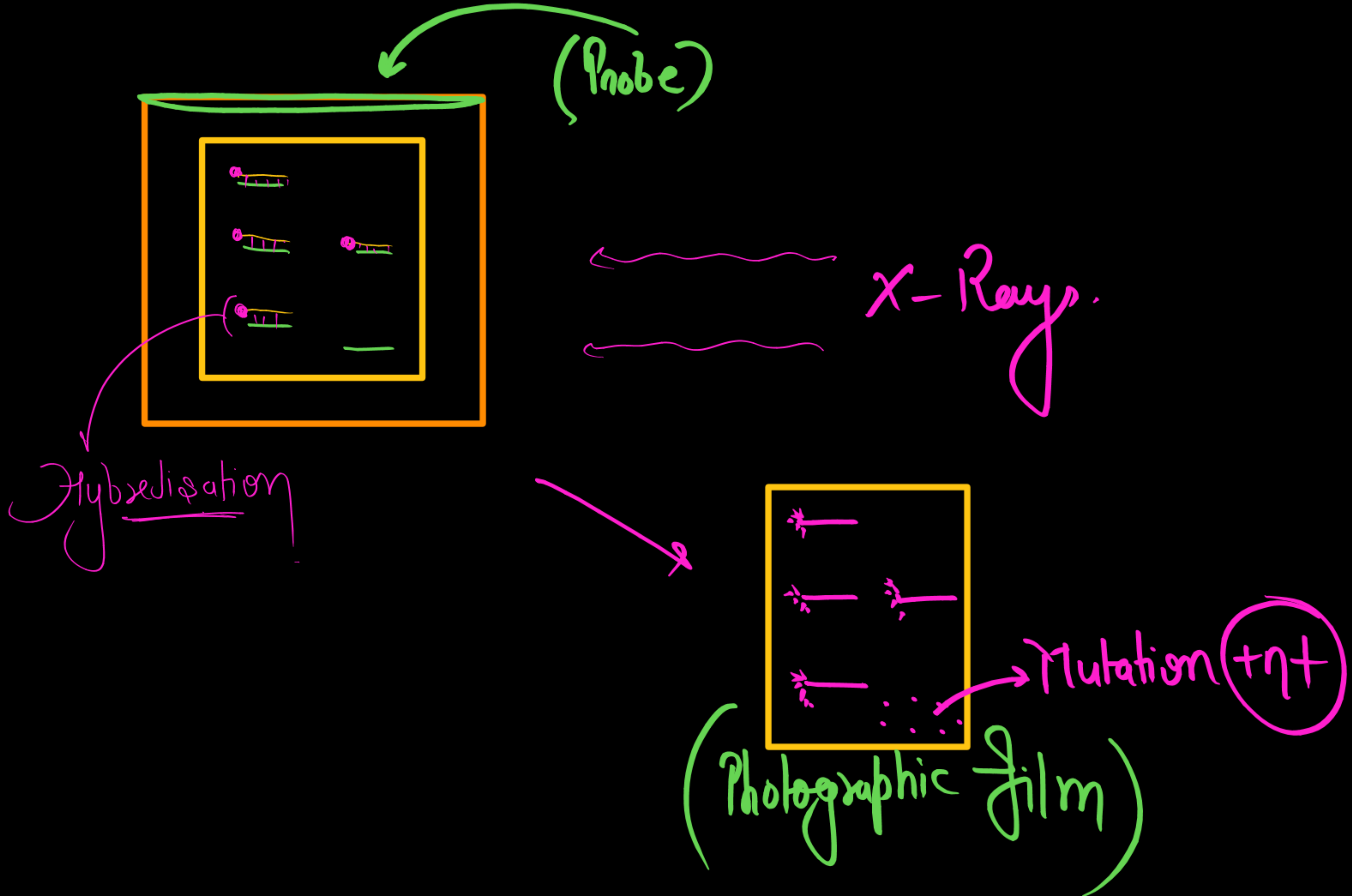
(1) PCR

- Presence of a pathogen (bacteria, viruses, etc.) is normally suspected only when the pathogen has produced a disease symptom. By this time the concentration of pathogen is already very high in the body.
- However, very low concentration of a bacteria or virus (at a time when the symptoms of the disease are not yet visible) can be detected by amplification of their nucleic acid by PCR
- PCR is now routinely used to detect HIV, mutations in genes in suspected AIDS patients.

Autoradiography -

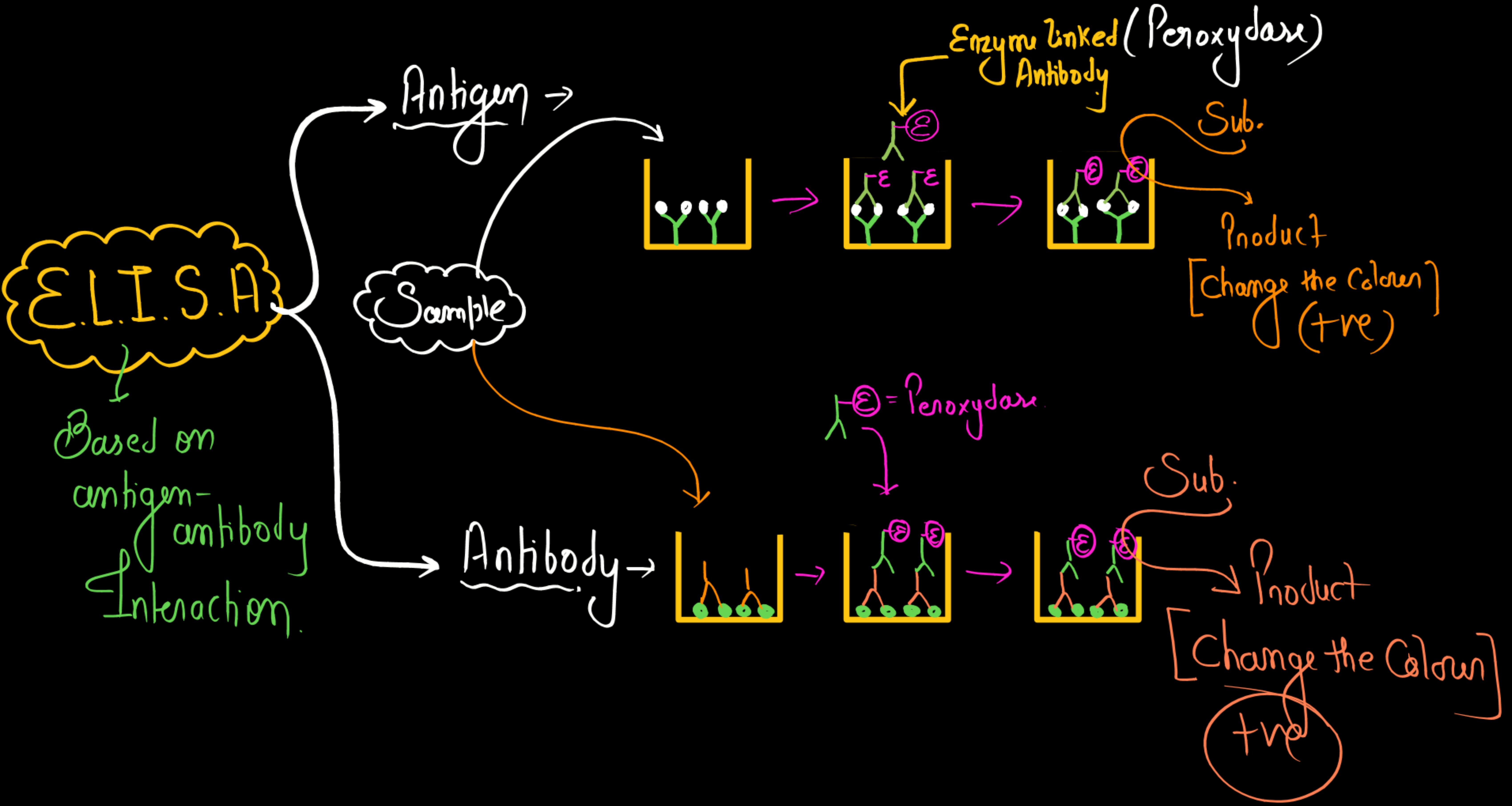
- A single stranded DNA or RNA, tagged with a radioactive molecule (probe) is allowed to hybridise to its complementary DNA in a clone of cells followed by detection using autoradiography.
- The clone having the mutated gene will hence not appear on the photographic film, because the probe will not have complementarity with the mutated gene.




(Probe)
X-Rays.
Hybridisation
Mutation
+nt
(Photographic film)

Enzyme Linked Immuno-sorbent Assay (ELISA)

- ELISA is based on the principle of antigen-antibody interaction.
- Infection by pathogen can be detected by the presence of antigens (proteins, glycoproteins, etc.) or by detecting the antibodies synthesized against the pathogen.



E.L.I.S.A
Based on antigen-antibody Interaction.
Antigen
Sample
Enzyme linked Antibody (Peroxydase)
E
Sub.
Product
[Change the Colour]
(+ve)
E = Peroxydase
Antibody
Sub.
Product
[Change the Colour]
+ve

TRANSGENIC ANIMALS

- Animals that have had their DNA manipulated to possess and express an extra (foreign) gene are known as transgenic animals.
- Transgenic rats, rabbits, pigs, sheep, cows and fish have been produced, **although over 95 per cent of all existing transgenic animals are mice.**

Mice

Why are these animals being produced? some of the common reasons:

(i) Normal physiology and development:

- Transgenic animals can be specifically designed to allow the study of how genes are regulated, and how they affect the normal functions of the body and its development, e.g., study of complex factors involved in growth such as insulin-like growth factor.
- By introducing genes from other species that alter the formation of this factor and studying the biological effects that result, information is obtained about the biological role of the factor in the body.

(ii) Study of disease:

- Many transgenic animals are designed to increase our understanding of how genes contribute to the development of disease.
- These are specially made to serve as models for human diseases so that investigation of new treatments for diseases is made possible.
- Today transgenic models exist for many human diseases such as cancer, cystic fibrosis, rheumatoid arthritis and Alzheimer's.

(iii) Biological products:

- Transgenic animals that produce useful biological products can be created by the introduction of the portion of DNA (or genes) which codes for a particular product such as human protein **(α-1-antitrypsin) used to treat emphysema.** Similar attempts are being made for treatment of phenylketonuria (PKU) and cystic fibrosis.
- In **1997, the first transgenic cow, Rosie**, produced human protein-enriched milk (2.4 grams per litre). The milk contained the human alpha-lactalbumin and was nutritionally a more balanced product for human babies than natural cow-milk.

(iv) Vaccine safety:

Transgenic mice are being developed for use in testing the safety of vaccines before they are used on humans. Transgenic mice are being used to test the safety of the polio vaccine. If successful and found to be reliable, they could replace the use of monkeys to test the safety of batches of the vaccine.

(v) Chemical safety testing:

This is known as toxicity/safety testing. The procedure is the same as that used for testing toxicity of drugs.

ETHICAL ISSUES

- The manipulation of living organisms by the human race cannot go on any further, without regulation.
- Genetic modification of organisms can have unpredicatable results when such organisms are introduced into the ecosystem.
- **Therefore, the Indian Government has set up organisations such as GEAC (Genetic Engineering Approval Committee), which will make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services.**
- The modification/usage of living organisms for public services (as food and medicine sources, for example) has also created problems with patents granted for the same.

Patent

- A set of exclusive rights granted by a national government to an inventors.
- Criteria for patent - Novelty, non-obviousness and utility.
- A patent is granted for (a) an invention (including a product), (b) an improvement in an earlier invention,(c) the process of generating a product, and (d) a concept or design.
- Initially, patents were granted for industrial inventions etc. But at present, patents are being granted for biological entities and for products derived from them, these patents are called biopatents.
- Primarily, industrialised countries, like U.S.A., Japan and members of European Union, are awarding Biopatents.

- There is growing public anger that certain companies are being granted patents for products and technologies that make use of the genetic materials, plants and other biological resources that have long been identified, developed and used by farmers and indigenous people of a specific region/country.

- Rice is an important food grain, the presence of which goes back thousands of years in Asia's agricultural history. There are an estimated **200,000 varieties of rice in India alone**. The diversity of rice in India is one of the richest in the world. Basmati rice is distinct for its unique aroma and flavour and 27 documented varieties of Basmati are grown in India. There is reference to Basmati in ancient texts, folklore and poetry, as it has been grown for centuries.

- In 1997, an American company got patent rights on Basmati rice through the US Patent and Trademark Office.
- This allowed the company to sell a 'new' variety of Basmati, in the US and abroad. This 'new' variety of Basmati had actually been derived from Indian farmer's varieties.
- Indian Basmati was crossed with semi-dwarf varieties and claimed as an invention or a novelty.

- Several attempts have also been made to patent uses, products and processes based on Indian traditional herbal medicines, e.g., turmeric neem. If we are not vigilant and we do not immediately counter these patent applications, other countries/individuals may encash on our rich legacy and we may not be able to do anything about it.

Biopiracy

Biopiracy is the term used to refer to the use of bio-resources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment.

Most of the industrialised nations are rich financially but poor in biodiversity and traditional knowledge. In contrast the developing and the underdeveloped world is rich in biodiversity and traditional knowledge related to bio-resources. Traditional knowledge related to bio-resources can be exploited to develop modern applications and can also be used to save time, effort and expenditure during their commercialisation.

A west African plant *Pentadiplandra brazzeana* produces a protein called brazzein which is approximately 2,000 times as sweet as sugar. In addition, brazzein is a low-calorie sweetener. But the protein brazzein was patented in U.S.A. Subsequently, the gene encoding brazzeinwas also isolated, sequenced and patented in U.S.A. It is proposed to transfer the brazzein gene into maize and express it in maize kernels. These kernels will then be used for the extraction of brazzein.

The Indian Parliament has recently cleared the second amendment of the Indian Patents Bill, that takes such issues into consideration, including patent terms emergency provisions and research and development initiative.

1. ______ is used to refer to the use of bio-resources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment

(1) Bioexploitation

(2) Biopiracy

(3) Biofortification

(4) Bioinformatics

A ‘new’ variety of rice was patented by a foreign company, though such varieties have been present in India for a long time. This is related to

(1) Co-667 (2) Sharbati Sonora

(3) Lerma Rojo (4) Basmati

A company has developed a GM maize plant which produces high amount of sugar. The right granted to the company because of which others cannot use it is

(1) Biopiracy
(2) Eugenics
(3) Biopatent
(4) Bioethics

Organisms which can be used to gain commercial benefits are called

(1) Beneficial resources
(2) Biopiracy
(3) Financial resources
(4) Biological resources

Which step Government of India has taken to cater requirement of patent terms and other emergency provisions in this regard?

(1) Biopiracy act

(2) Indian patents bill

(3) RTI act

(4) GEAC

The use of bioresources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment is called

(1) Bioethics

(2) Biopiracy

(3) Bio-pesticide

(4) Bioremediation

Earlier which animals were used to test the safety of polio vaccine

(1) Transgenic rat

(2) Transgenic pigs

(3) Transgenic mice

(4) Transgenic sheep

Amount of alpha-lactalbumin in the milk of transgenic cow is

(1) 4.2 grams per litre
(2) 2.4 grams per litre
(3) 3.4 grams per litre
(4) 4.2 grams per litre

A monopoly granted to a person who has invented a new and useful article, made improvement in an existing article or invented a new process of making an article is called_______

(1) Bioethics
(2) Patent
(3) Biopiracy
(4) Genetic recombination

A transgenic plant having higher storage protein is

(1) Rice

(2) Maize

(3) Potato

(4) Tomato

Biopatents are

I. Right to use invention

II. Right to use products

III. Right to use biological entities

IV. Right to use process

(1) I & III (2) III only

(3) I, III, IV (4) All of the above

4

How many documented varieties of Basmati rice are grown in India?

(1) 2,00,000 (2) 50,000

(3) 1,000 (4) 27

(4)

THANK YOU !!

MANTHAN NEET

BIOTECHNOLOGY : PRINCIPLES AND PROCESSES

LECTURE - 1

ZOOLOGY



MD SIR

TODAY'S GOAL

- BIOTECHNOLOGY : PRINCIPLES

10 - 12 Q

Old Biotechnology –

techniques of using live organisms or enzymes from organisms to produce products and processes useful to humans.

Today Biotechnology -

in vitro fertilization leading to a ‘test-tube’ baby, synthesizing a gene and using it, developing a DNA vaccine or correcting a defective gene, are all part of biotechnology.

According to The European Federation of Biotechnology (EFB)

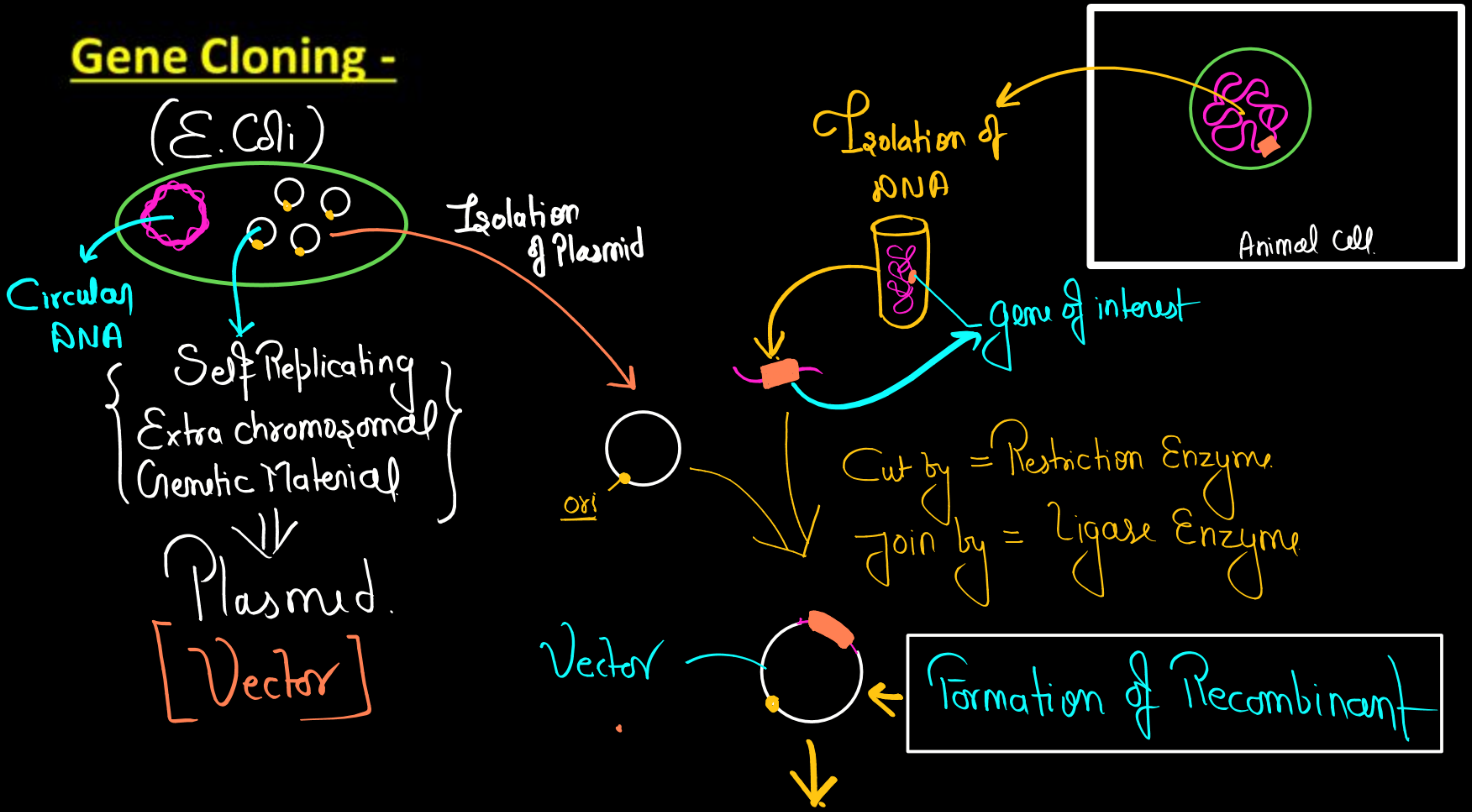
‘The integration of natural science and organisms, cells, parts thereof, and molecular analogues for products and services’.

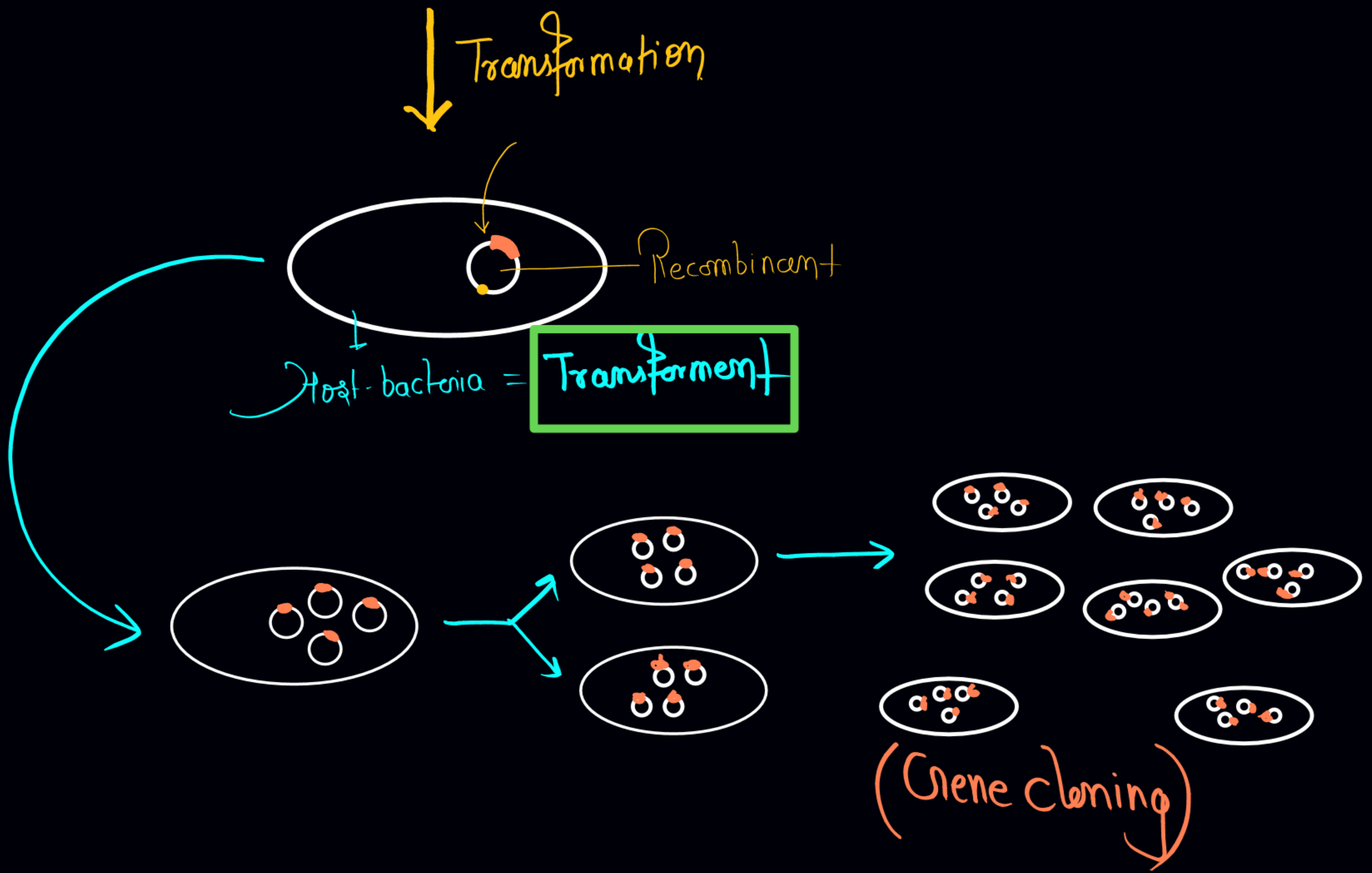
PRINCIPLES OF BIOTECHNOLOGY

(i) Genetic engineering : Techniques to alter the chemistry of genetic material (DNA and RNA), to introduce these into host organisms and thus change the phenotype of the host organism.

(ii) Bioprocess engineering: Maintenance of sterile (microbial contamination-free) ambience in chemical engineering processes to enable growth of only the desired microbe/eukaryotic cell in large quantities for the manufacture of biotechnological products like antibiotics, vaccines, enzymes, etc.

Gene Cloning -

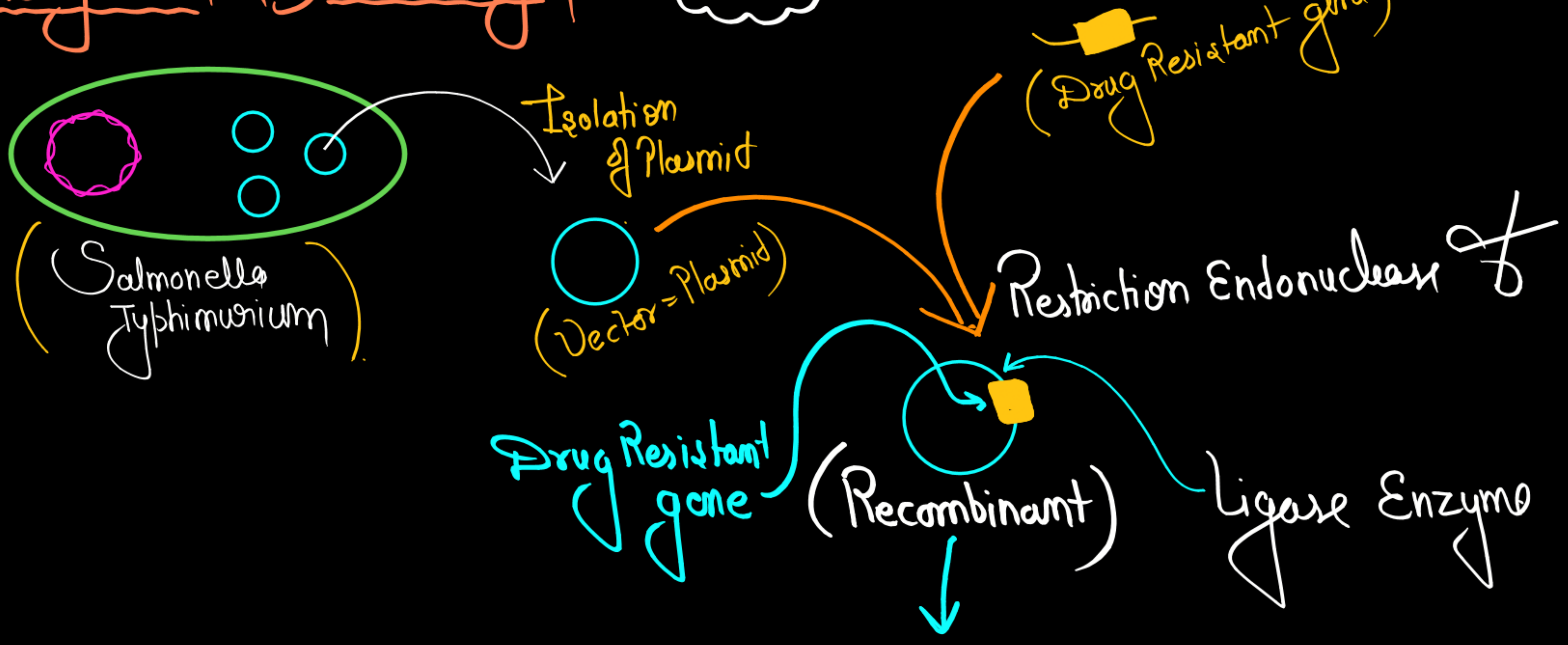




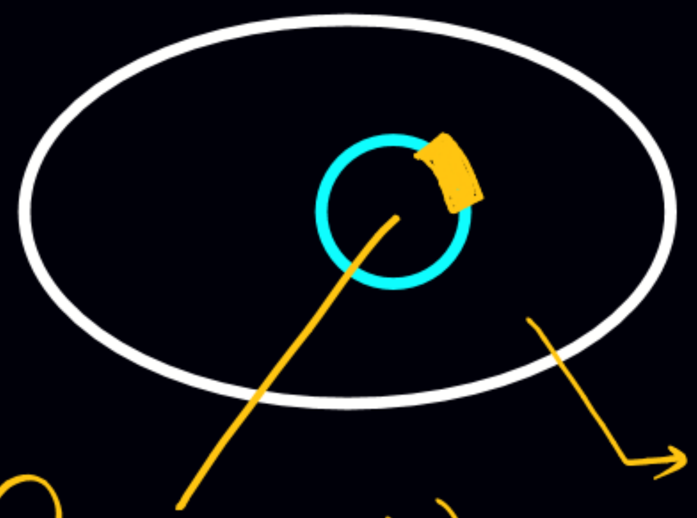
Transformation
Recombinant
Host-bacteria = Transforment
(Gene cloning)

Construction of first artificial recombinant DNA molecule -

(Stenly Cohen & Herbert boyer ⇒ 1972)



Transformation in E.Coli



(Recombinant)

= E.Coli = Transforment

Drug Sensitive E.Coli

Convert into →

Drug-Resistant E.Coli

You can hence infer that there are three basic steps in genetically modifying an organism —

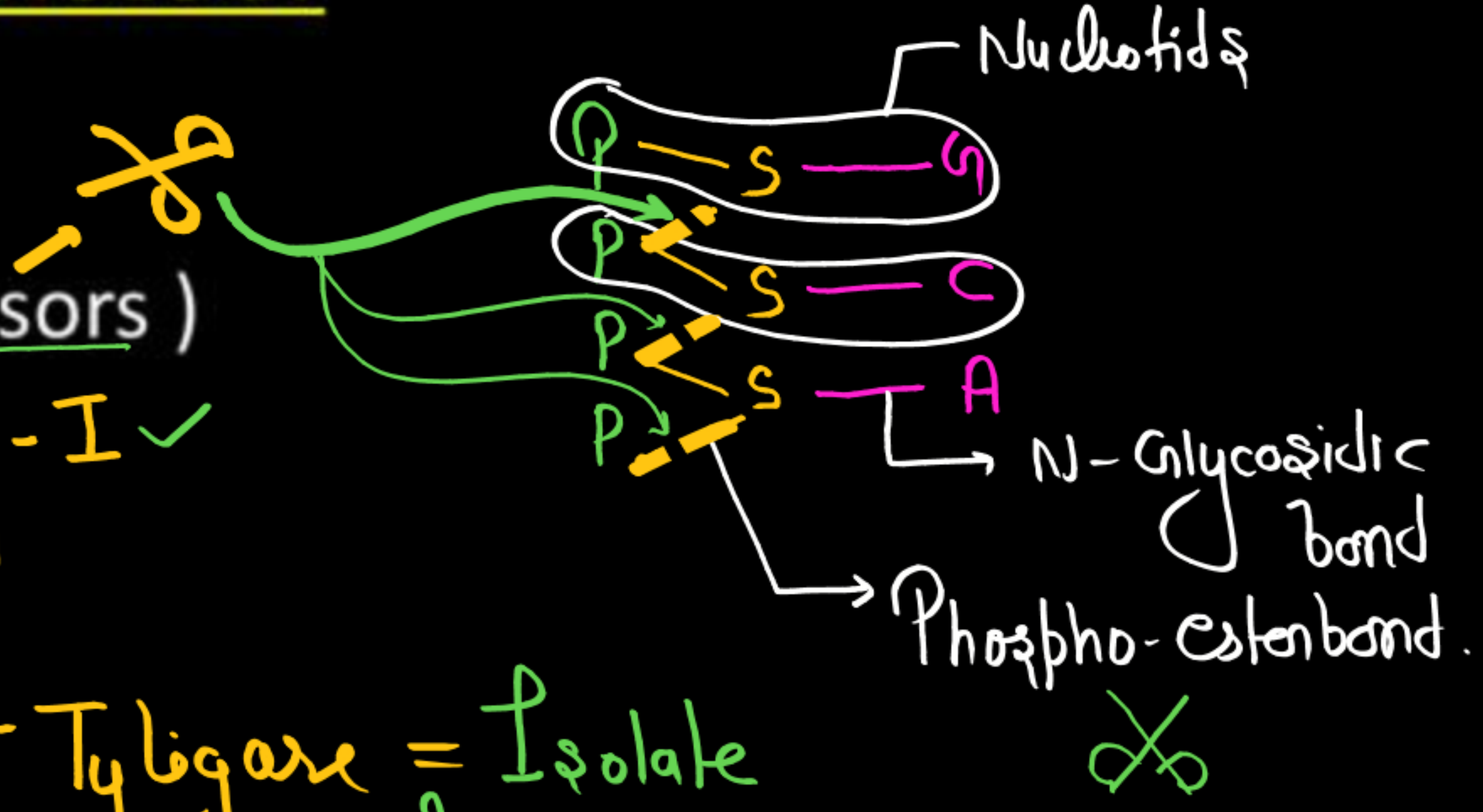
(i) identification of DNA with desirable genes;
(ii) introduction of the identified DNA into the host;
(iii) maintenance of introduced DNA in the host and transfer of the DNA to its progeny.

TOOLS OF RECOMBINANT DNA TECHNOLOGY

(1) DNA manipulating enzymes -
- Restriction enzymes (molecular scissors)
- Polymerase enzymes → DNA-Poly-I
- Ligases (molecular glue)

(2) Vectors (molecular Vehicle)

(3) Host organism



T4 ligase = Isolate from T4-Bacteriophage Virus

join Phospho-Ester bond.

THANK YOU !!

MANTHAN NEET

BIOTECHNOLOGY : PRINCIPLES AND PROCESSES

LECTURE - 2

ZOOLOGY



MD SIR

TODAY'S GOAL

- ❑ Restriction enzymes vvv Imp

TOOLS OF RECOMBINANT DNA TECHNOLOGY

(1) DNA manipulating enzymes -

- Restriction enzymes (molecular scissors)
- Polymerase enzymes
- Ligases (molecular glue)

(2) Vectors (molecular Vehicle)

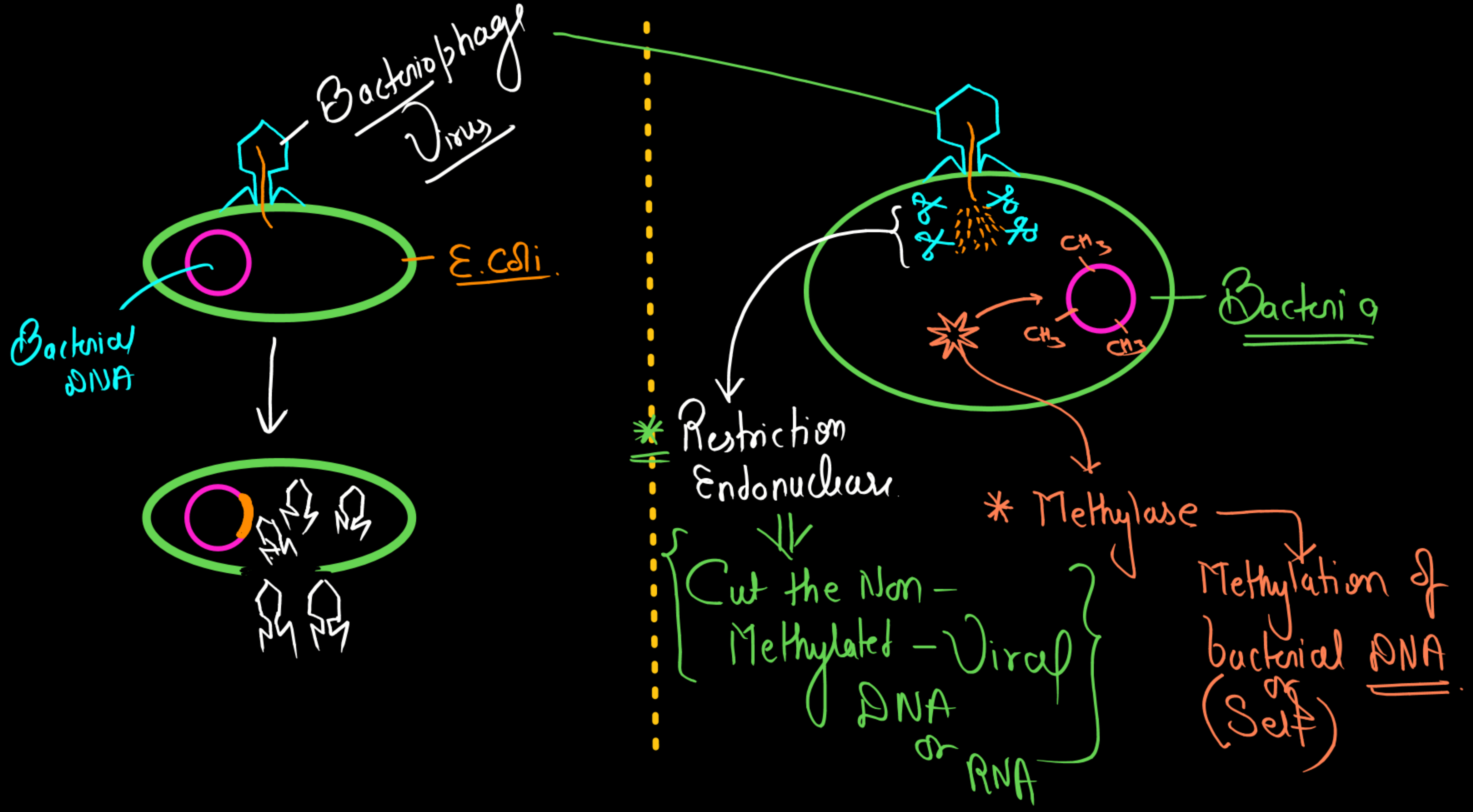
(3) Host organism

Restriction enzymes (molecular scissors) –

- Restriction enzymes were first postulated by W. Arber in 1963.
- The first true restriction endonucleases was isolated in 1970 by Nathans and Hamilton Smith.
- All three scientists were awarded the Noble Prize for Physiology and Medicine in 1978 for the discovery of endonucleases.



- In the year 1963, the two enzymes responsible for restricting the growth of bacteriophage in *Escherichia coli* were isolated. One of these added methyl groups to DNA (methylase), while the other cut DNA. The later was called restriction endonuclease

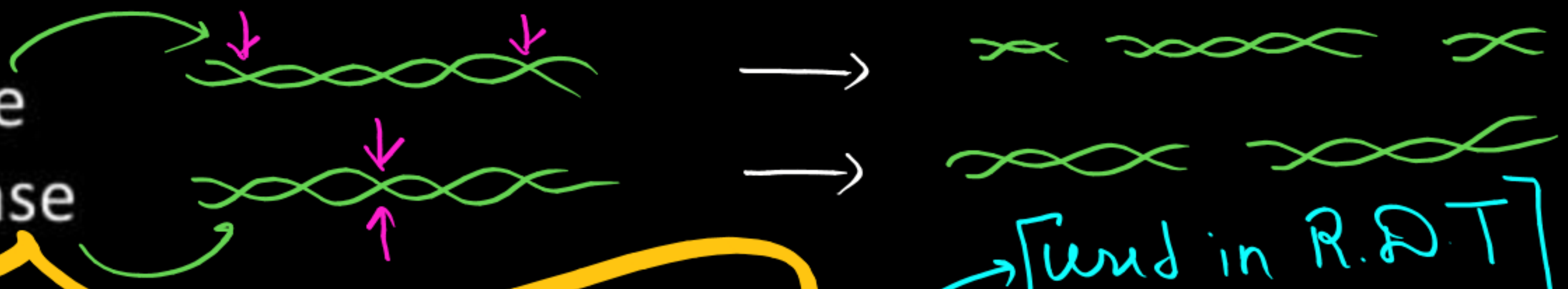


Bacteriophage
Virus
E.Coli
Bacterial DNA
CH3
CH3
CH3
Bacteria
* Restriction Endonuclease
Cut the Non-Methylated - Viral DNA or RNA
* Methylase
Methylation of bacterial DNA (Self)

Classification of R. Enzymes →

- Restriction enzymes belong to a larger class of enzymes called nucleases. These are of two kinds; -

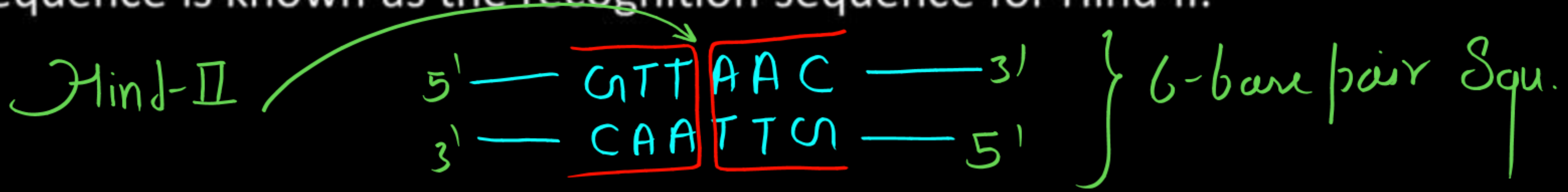
1. Exonuclease
2. Endonuclease



Type I (Arber)
- Mg^{++}
- A.T.P. ✗
- 3-unit
  - Recognisation of Specific Site
  - Methylation
  - Cut Randumlly at DNA ✗

Type II (Hamilton Smith) [used in R.D.T]
- Mg^{++} ✓
- Two unit
  - Recognization of Specific Site.
  - Cut the DNA at Specific Site. ✓

The first restriction endonuclease – Hind II (Type-II), whose functioning depended on a specific DNA nucleotide sequence was isolated (Hamilton Smith) and characterised five years later. It was found that Hind II always cut DNA molecules at a particular point by recognising a specific sequence of six base pairs. This specific base sequence is known as the recognition sequence for Hind II.



5' —— GT (Pyrimidine T or C) (Purine A or G) AC —— 3’

3' —— CA (Purine A or G) (Pyrimidine T or C) TG —— 5

Hind-II-(Cut)

- Besides Hind II, today we know more than 900 restriction enzymes that have been isolated from over 230 strains of bacteria each of which recognise different recognition sequences.

Palindromic sequences

Each restriction endonuclease recognises a specific palindromic nucleotide sequences in the DNA.

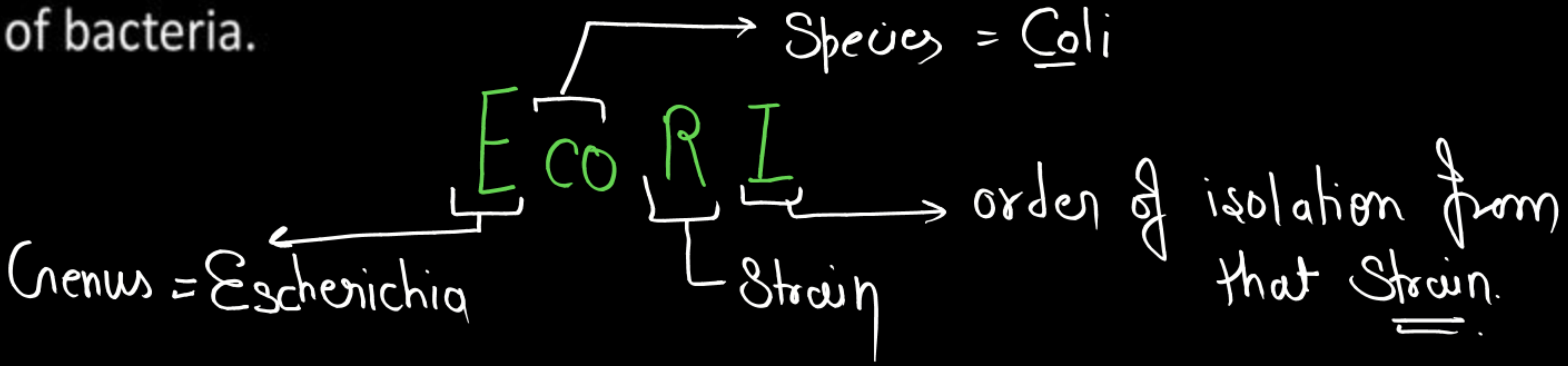
MALAYALAM”

5' —— GAATTC —— 3’
3' —— CTTAAG —— 5’

***Eco* RI**

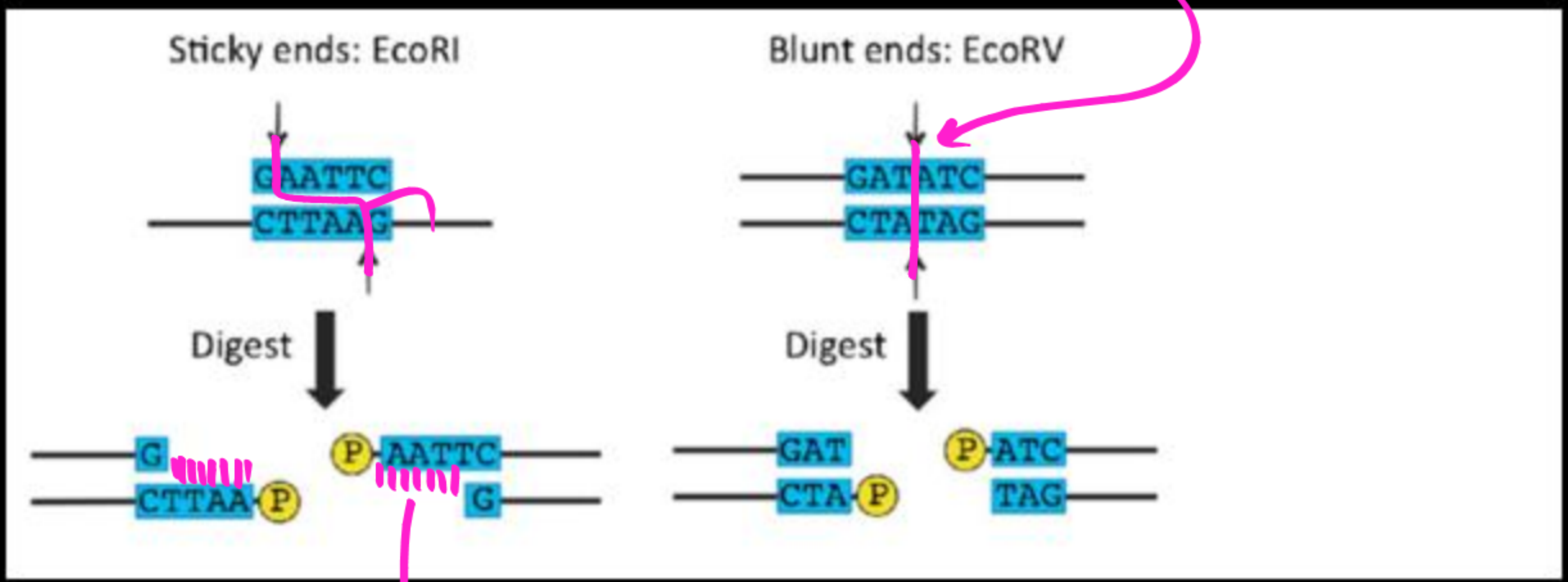
Nomenclature of restriction enzymes –

- First letter of the name - genus
- Second two letters - species of the prokaryotic cell from which they were isolated, e.g., *Eco* RI comes from *Escherichia coli* RY 13.
- In *Eco* RI, the letter 'R' is derived from the name of strain.
- Roman numbers - order in which the enzymes were isolated from that strain of bacteria.

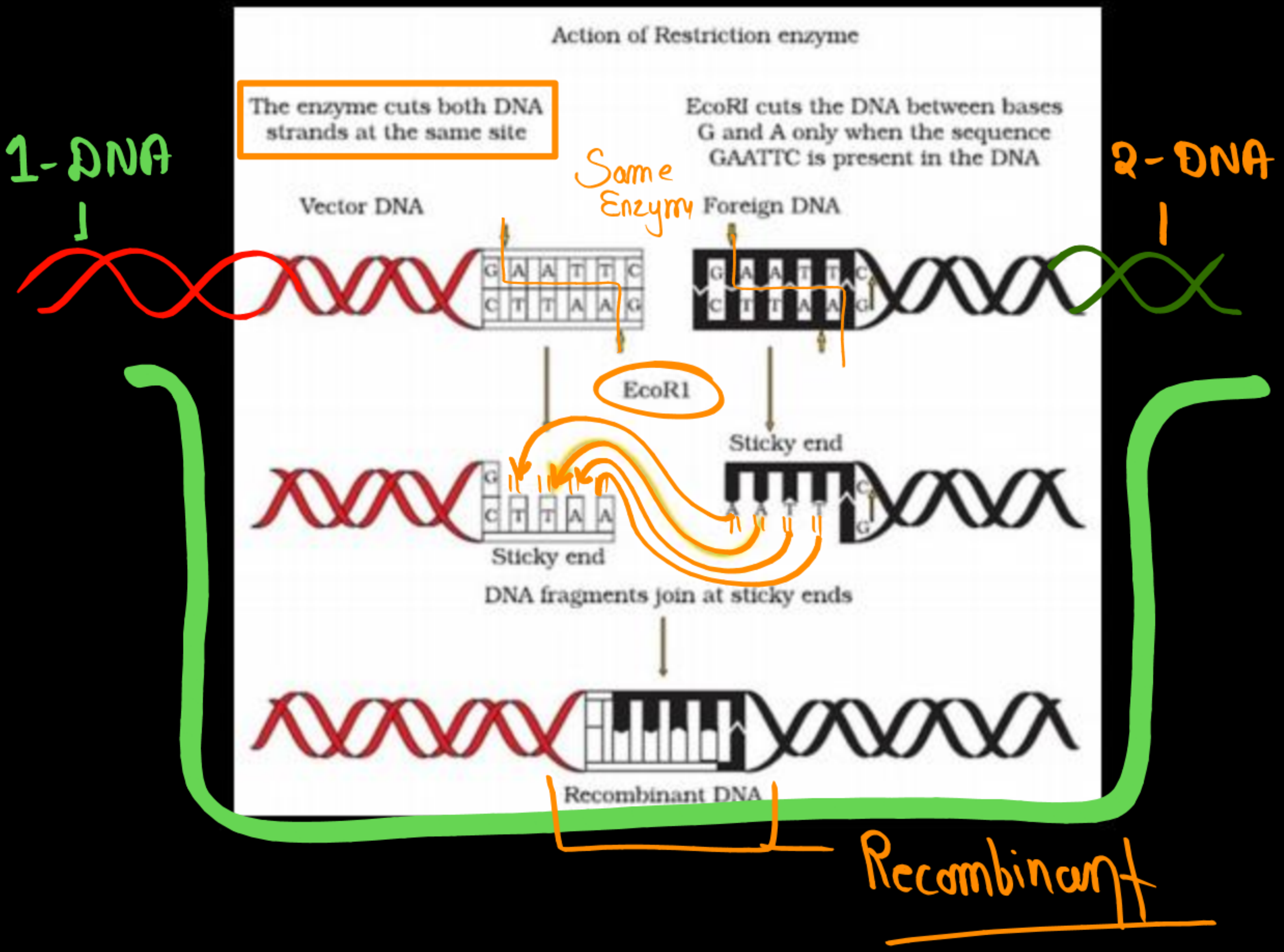


Working of Restriction Enzymes

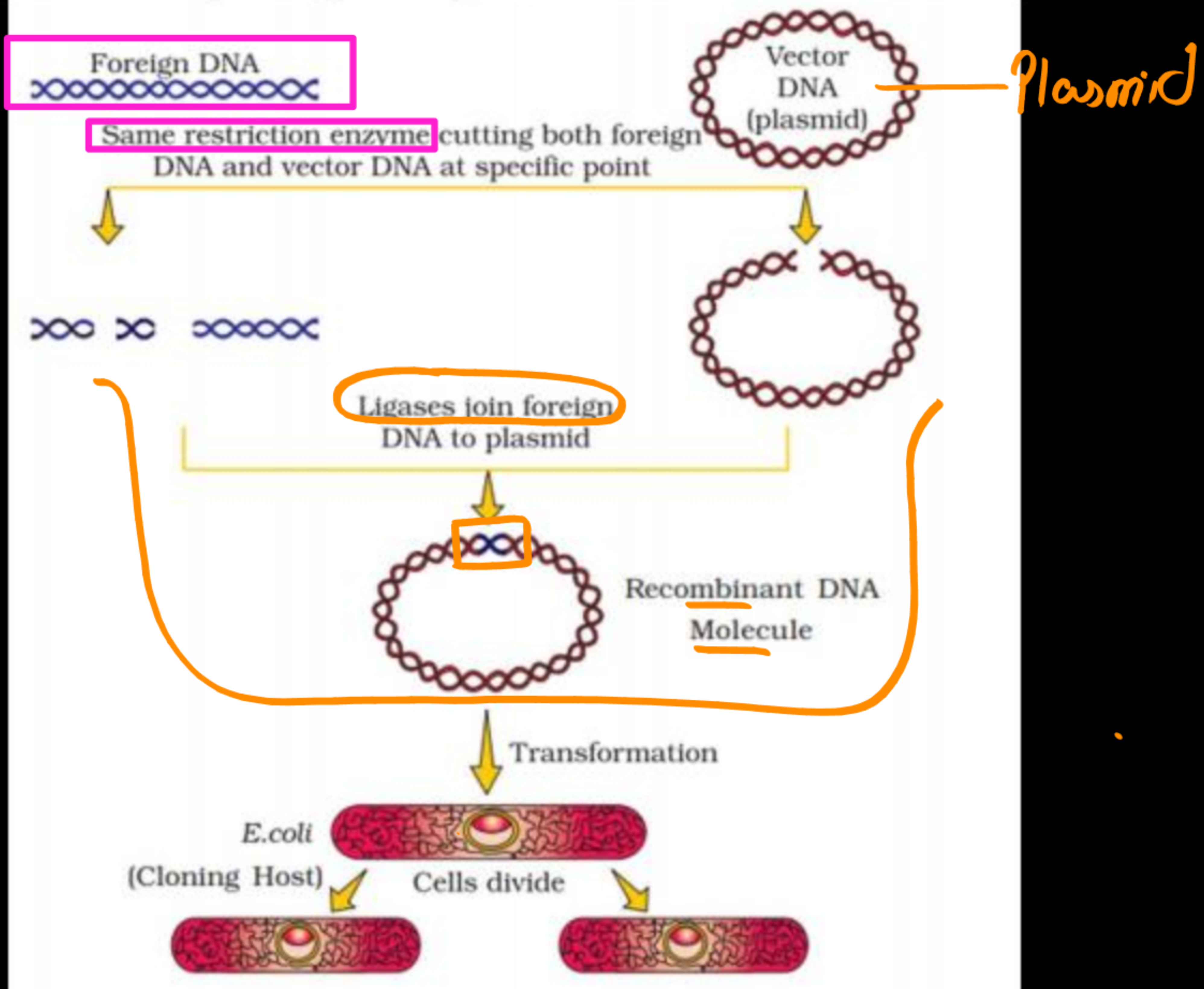
Sticky ends Blunt ends.



(free H-bond)



Action of Restriction enzyme
The enzyme cuts both DNA strands at the same site
EcoRI cuts the DNA between bases G and A only when the sequence GAATTC is present in the DNA
1-DNA
2-DNA
Same Enzym
Vector DNA
Foreign DNA
G A A T T C
C T T A A G
EcoR1
Sticky end
Sticky end
DNA fragments join at sticky ends
Recombinant DNA
Recombinant



ure 11.2 Diagrammatic representation of recombinant DNA technology

THANK YOU !!

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BIOTECHNOLOGY : PRINCIPLES AND PROCESSES

LECTURE - 3

ZOOLOGY



MD SIR

TODAY'S GOAL

- ❑ Cloning Vectors ✓
- ❑ Host ✓

TOOLS OF RECOMBINANT DNA TECHNOLOGY

(1) DNA manipulating enzymes -

- Restriction enzymes (molecular scissors)
- Polymerase enzymes
- Ligases (molecular glue)

(2) Vectors (molecular Vehicle)

(3) Host organism

Cloning Vectors

- You know that plasmids and bacteriophages have the ability to replicate within bacterial cells independent of the control of chromosomal DNA.
- Bacteriophages because of their high number within the bacterial cells.
- Some plasmids may have only one or two copies per cell whereas others may have 15-100 copies per cell.

Essential features of a vector are –

(1) Origin of replication (ori):

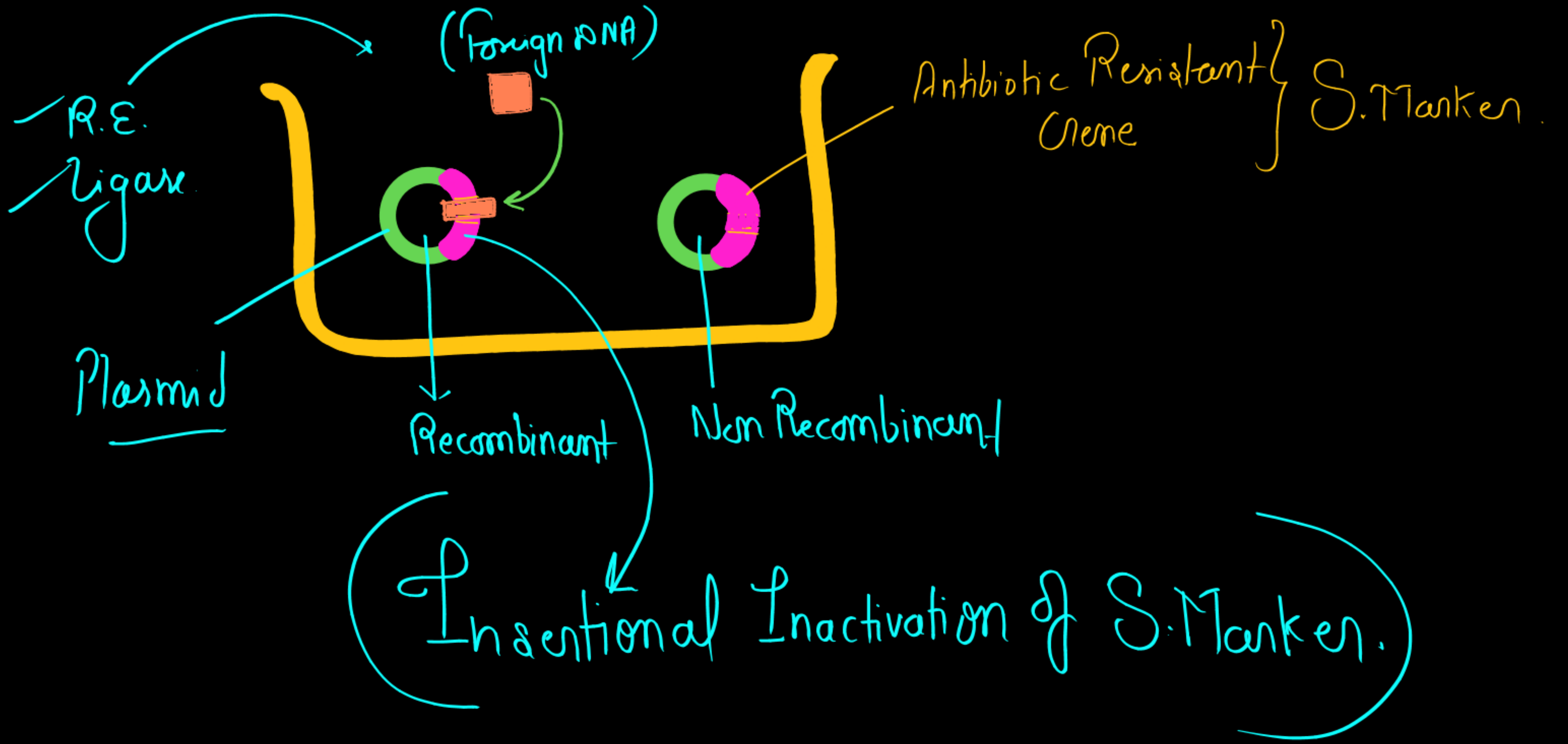


(2) Selectable marker : In addition to 'ori', the vector requires a selectable marker, which helps in identifying and eliminating non transformants and selectively permitting the growth of the transformants.

Eg.

- Antibiotics resistance genes.
- Lac Z gene for B –galactosidase enzyme (produce colour in the presence of a chromogenic substrate)

Selection of recombinants and transformant - based on inactivation of antibiotic resistant gene or Lac Z gene (Insertional inactivation).



(3) Cloning sites : Palindromic sequences (restriction site 4-8 nucleotides) present with in selectable marker

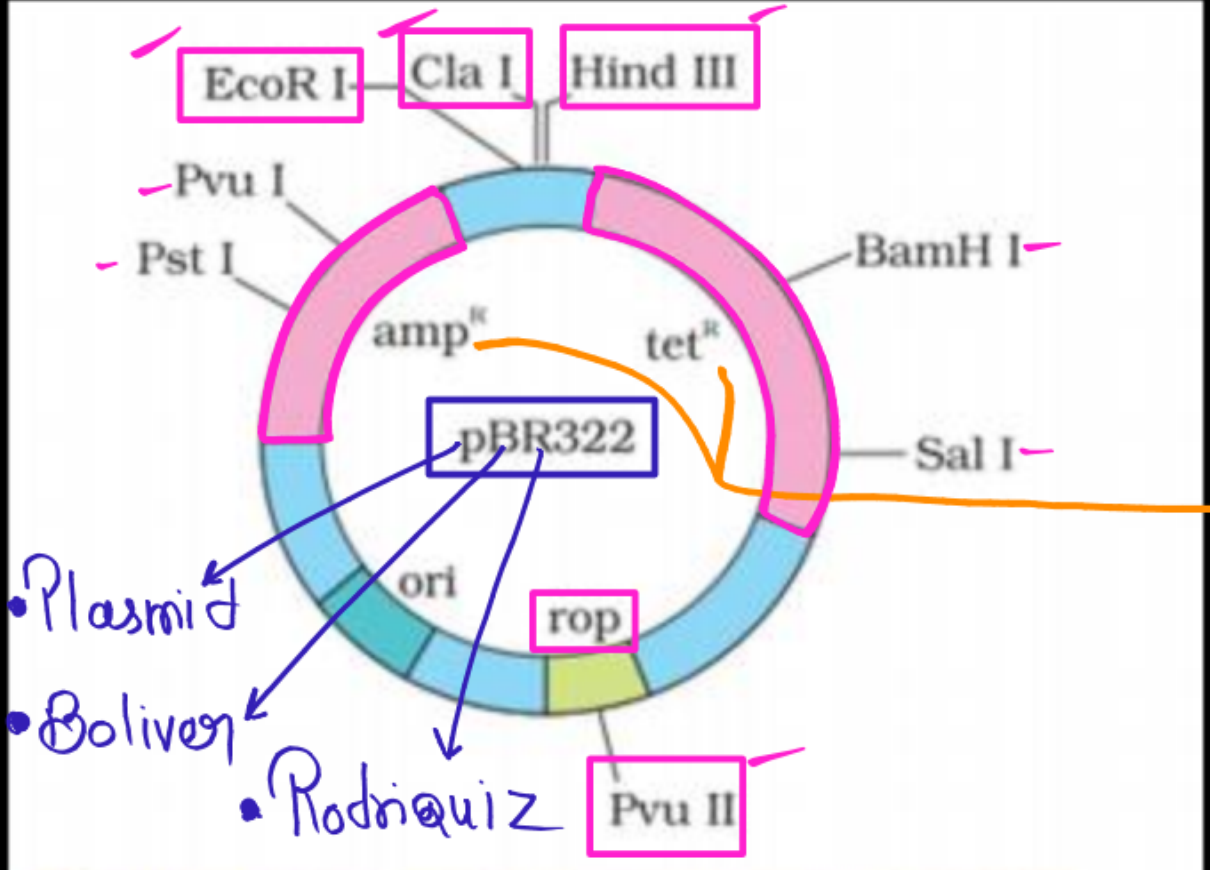
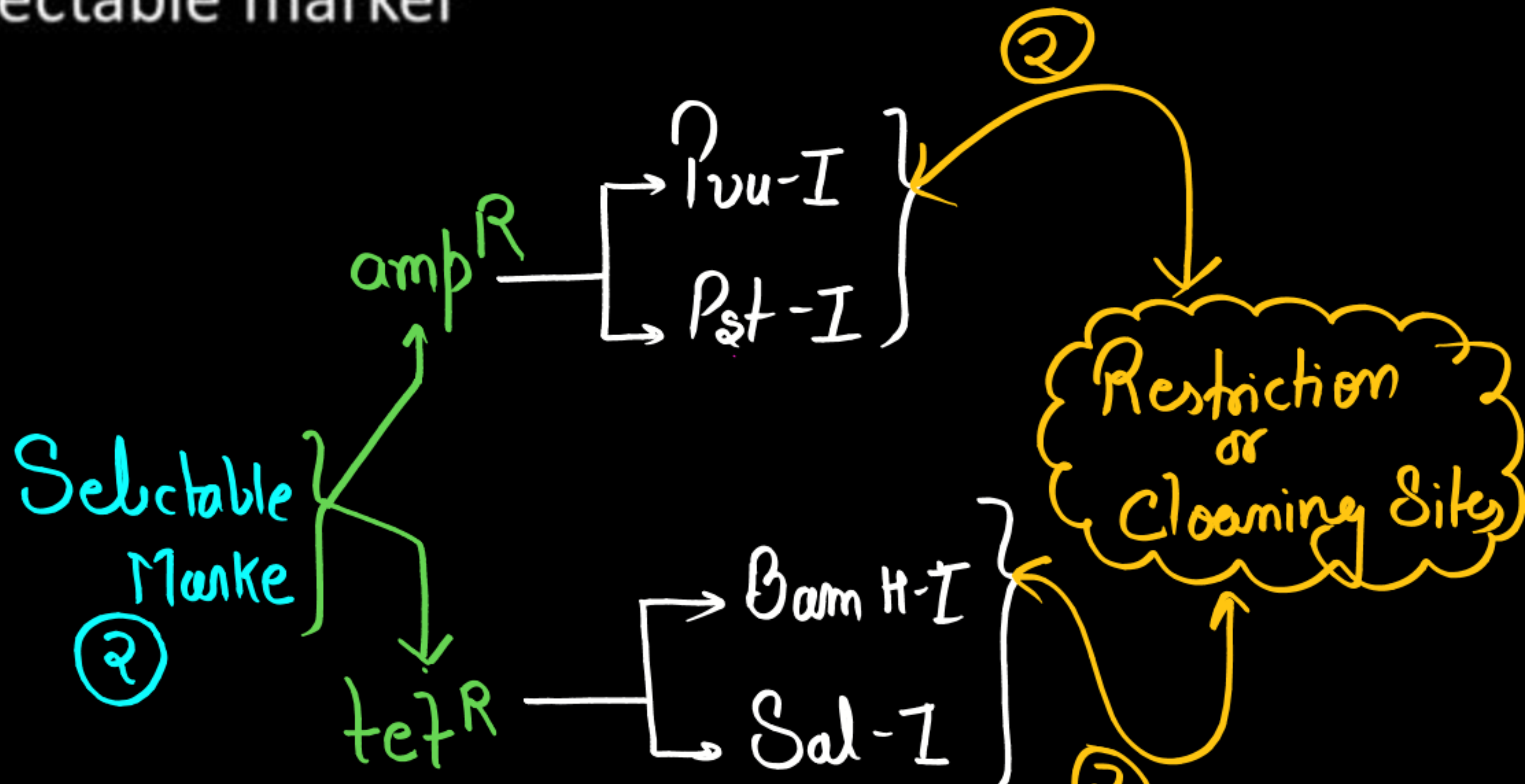
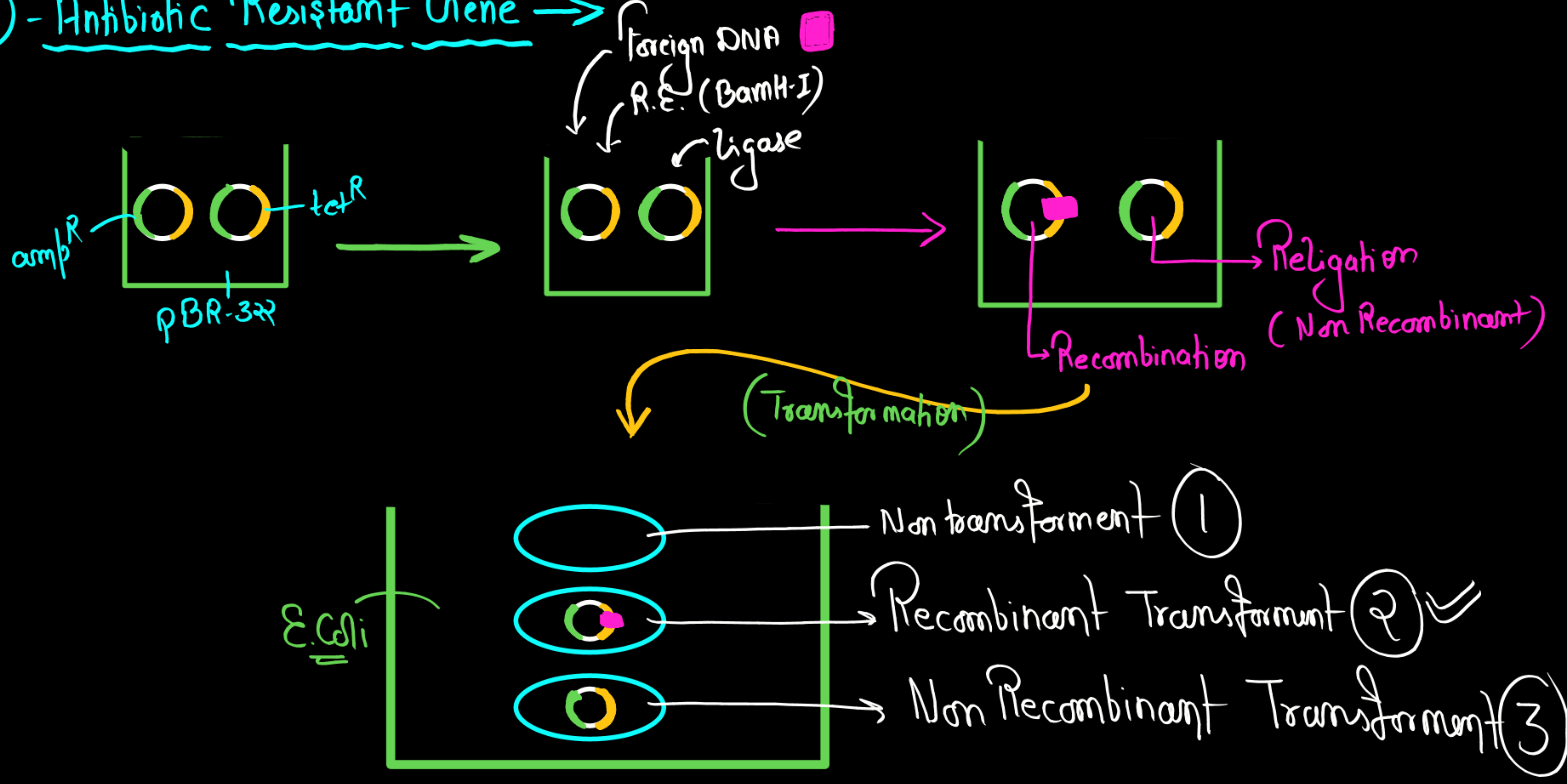


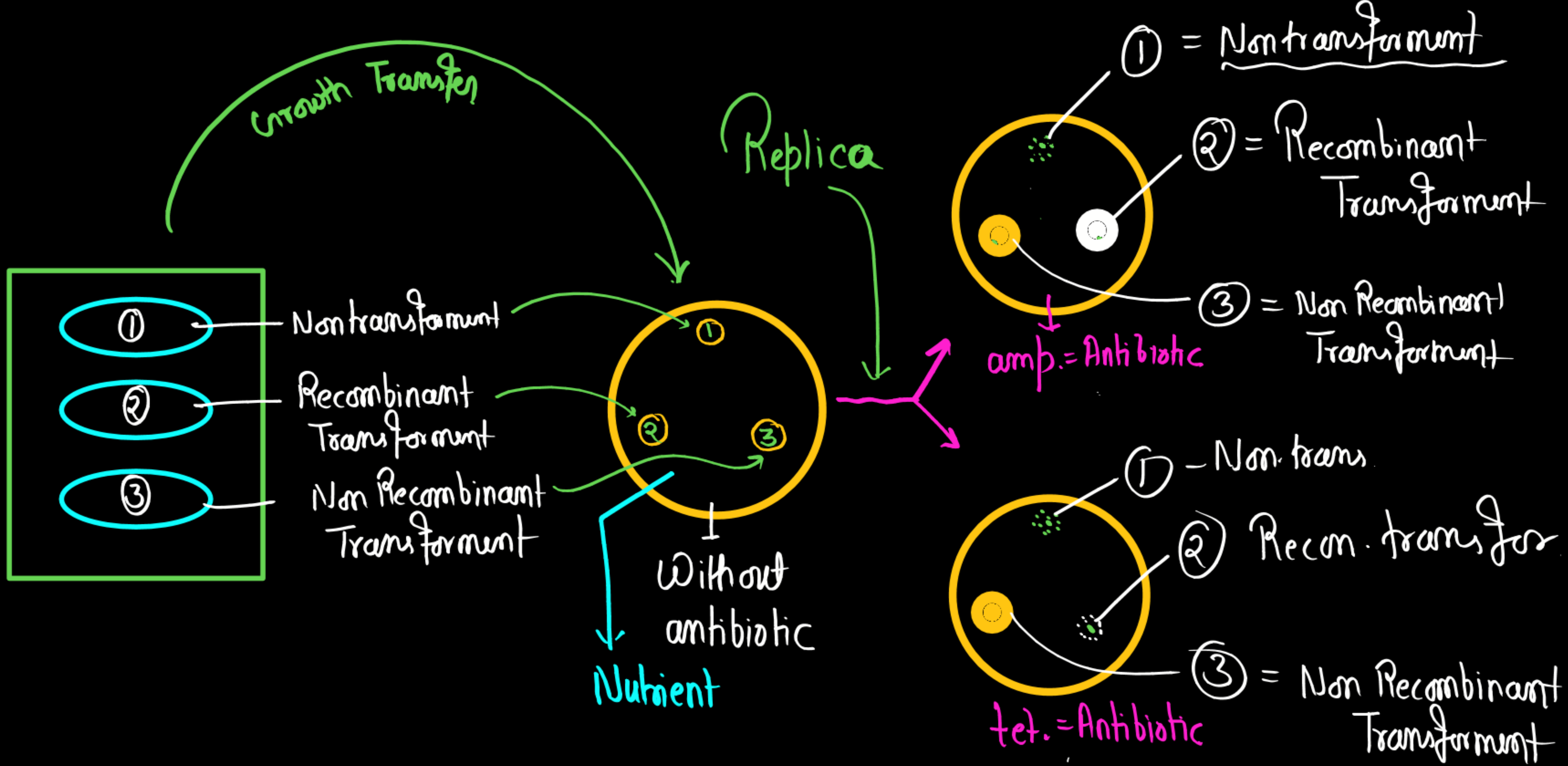
Figure 11.4 *E. coli* cloning vector pBR322 showing restriction sites (*Hind* III, *EcoR* I, *Bam*H I, *Sal* I, *Pvu* II, *Pst* I, *Cla* I), ori and antibiotic resistance genes (amp^R and tet^R). rop codes for the proteins involved in the replication of the plasmid.



Note → Total Cloaning Site = 8 → 4 in Selectable Marker; 4 outside the Selectable Marker

1) - Antibiotic Resistant Gene →





Growth Transfer
Replica
①
②
③
Nontransforment
Recombinant Transforment
Non Recombinant Transforment
Without antibiotic
Nutrient
① = Nontransforment
② = Recombinant Transforment
③ = Non Recombinant Transforment
amp. = Antibiotic
① - Non trans
② Recom. transfor
③ = Non Recombinant Transforment
tet. = Antibiotic

	AmpR	TetR.
Non Transformant	Growth -nt	-nt
Non Recombinant Transformant	+nt	+nt
Recombinant Transformant	+nt	-nt

Choose the **correct** pair from the following :

(1) Ligases - Join the two DNA molecules

(2) Polymerases - Break the DNA into fragments

(3) Nucleases - Separate the two strands of DNA

(4) Exonucleases - Make cuts at specific positions within DNA

The specific palindromic sequence which is recognized by EcoRI is :

(1) 5' - GAATTC - 3'
3' - CTTAAG - 5'

(2) 5' - GGAACC - 3'
3' - CCTTGG - 5'

(3) 5' - CTTAAG - 3'
3' - GAATTC - 5'

(4) 5' - GGATCC - 3'
3' - CCTAGG - 5'

Identify the **wrong** statement with regard to Restriction Enzymes.

(1) Each restriction enzyme functions by inspecting the length of a DNA sequence.

(2) They cut the strand of DNA at palindromic sites.

(3) They are useful in genetic engineering.

(4) Sticky ends can be joined by using DNA ligases.

Following statements describe the characteristics of the enzyme Restriction endonuclease. Identify the incorrect statement. [NEET-2019]

(1) The enzyme cuts DNA molecule at identified position within the DNA

(2) The enzyme binds DNA at specific sites and cuts only one of the two strands.

(3) The enzyme cuts the sugar-phosphate backbone at specific sites on each strand.

(4) The enzyme recognizes a specific palindromic nucleotide sequence in the DNA

Bacteria possessing restriction endonucleases remain

(1) Affected by bacteriophages
(2) Resistant to bacteriophages
(3) Resistant to drugs
(4) Resistant to heat

Introduction of foreign genes for improving genotype is called

(1) Biotechnology
(2) Tissue culture
(3) Genetic engineering
(4) Both (1) & (3)

Which of the following bonds are formed by action of DNA ligase?

(1) Sugar-phosphate bond
(2) Phosphodiester bond
(3) Phosphate-phoshpate bond
(4) Both (1) & (2)

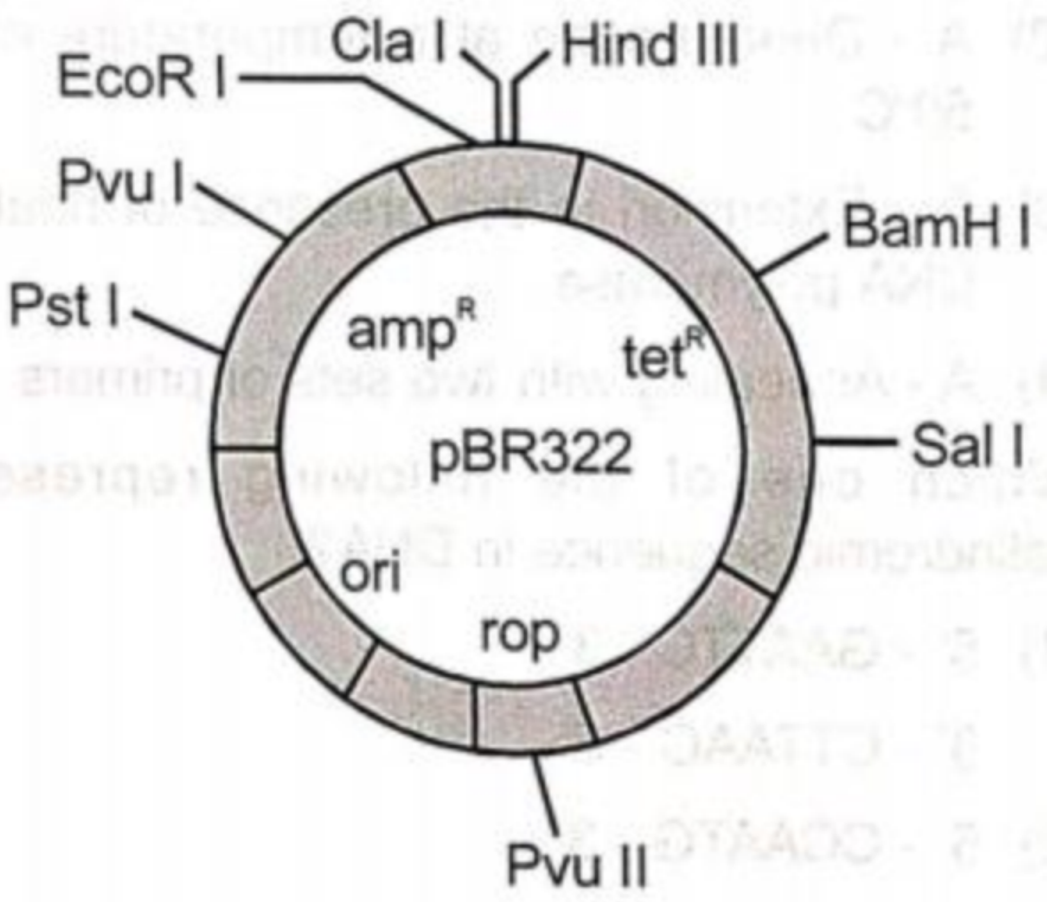
In recombinant DNA technology, a plasmid vector is cleaved by

(1)Modified DNA ligase
(2) A heated alkaline solution
(3) The same enzyme that cleaves donor DNA
(4) Different enzyme that cleaved the donor DNA

Who is given the credit for constructing first artificial recombinant molecule?

(1) Hargobind Khorana
(2) Stanley Cohen and Herbert Boyer
(3) Linus Pauling
(4) Arber and Nathans

The figure below is the diagrammatic representation of the *E.coli* vector pBR 322. Which one of the given options **correctly** identifies its certain component(s)?



(1) Hind III, EcoRI-selectable markers

(2) amp^R, tet^R-antibiotic resistance genes

(3) ori-original restriction enzyme

(4) rop-reduced osmotic pressure

The term ‘B’ and ‘R’ in the name pBR322 represents which of the following?

(1) Name of the scientists

(2) Name of the restriction endonuclease enzymes

(3) Name of cities in U.S.A.

(4) Name of the strain of bacterias used

What would happen if a recombinant DNA is inserted within the coding sequence of an enzyme, β-galactosidase?

(1) This will result in the inactivation of the enzyme

(2) The presence of chromogenic substrate will give blue coloured colonies

(3) The recombinant colonies do not produce any colour

(4) Both (1) & (3) are correct

The ability to transform normal cells into cancerous cells is found in

(1)Ti plasmid
(2) Retrovirus
(3) All plasmids
(4) Both (1) & (2)

Gene of interest was cloned at site Sal I in pBR322. The recombinant plasmid will exhibit susceptibility to

(1)Tetracycline
(2) Tetracycline and Ampicillin
(3) Ampicillin only
(4) Broad spectrum of antibiotics

Normal *E. coli* cells carry resistance against which of the following antibiotics?

(1)Chloramphenicol
(2) Ampicillin
(3) Tetracycline
(4) None of these

Although the Ti plasmid has revolutionised plant genetic engineering one limitation of its use is that it

(1) Cannot infect broad leaf plants
(2) Cannot be used on fruit-bearing plants
(3) Cannot transmit prokaryotic genes
(4) Does not infect cereal plants such as corn and rice

Which of the following is commonly used as a vector for introducing a DNA fragment in human lymphocytes?

[NEET-2018]

(1) λ phage
(2) Ti plasmid
(3) Retrovirus
(4) pBR 322

THANK YOU !!

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BIOTECHNOLOGY : PRINCIPLES AND PROCESSES

LECTURE - 4

ZOOLOGY

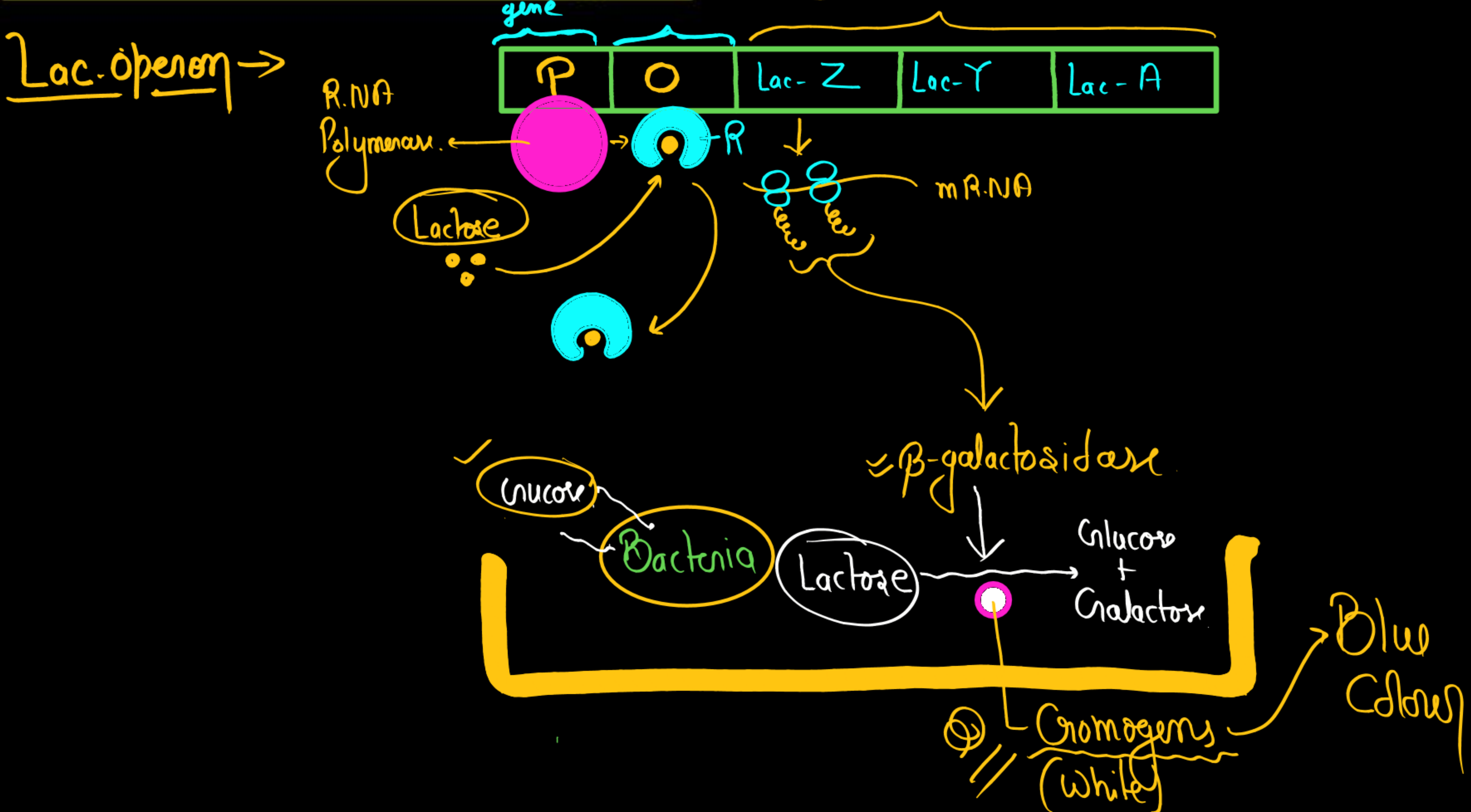


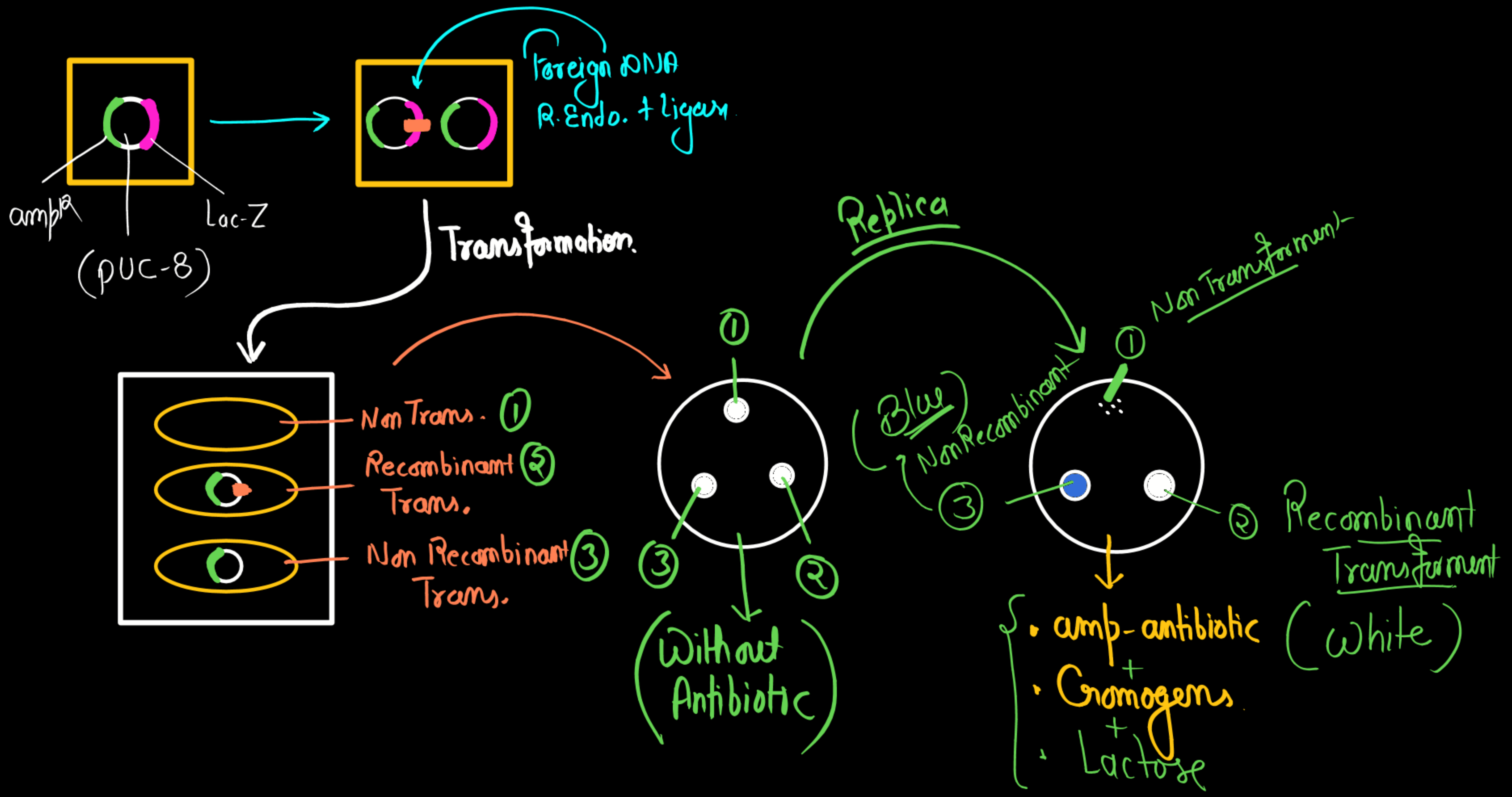
MD SIR

TODAY'S GOAL

- ❑ Cloning Vectors
- ❑ Host
- ❑ Process of recombinant DNA technology

Selectable Marker – Lac Z gene





Foreign DNA
R.Endo. + ligase
ampR
Lac-Z
(pUC-8)
Transformation
Non Trans. 1
Recombinant 2
Trans.
Non Recombinant 3
Trans.
1
2
3
Without Antibiotic
Replica
Non Transformant
1
(Blue) Non Recombinant
3
2
Recombinant Transformant
(White)
amp-antibiotic
+
Cromogens
+
Lactose

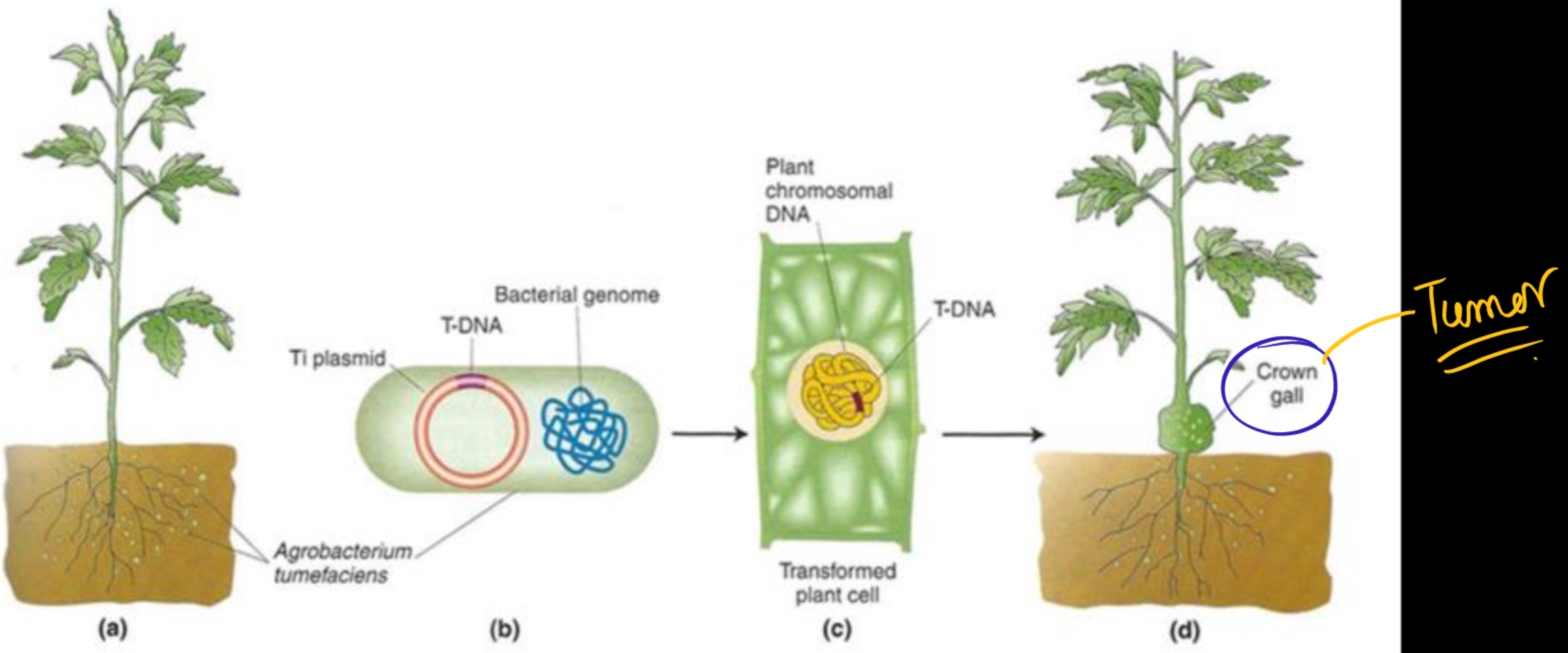
	Growth	White	Blue.
Non Transformant	-nt	×	×
Recombinant Trans.	+nt	✓	
Non Recombinant Transformant	+nt		✓

Vectors for cloning genes in plants and animals :

- **Plants** - *Agrobacterium tumifaciens*, a pathogen of several dicot plants is able to deliver a piece of DNA known as **'T-DNA'** to transform normal plant cells into a tumor and direct these tumor cells to produce the chemicals required by the pathogen.

- The tumor inducing (Ti) plasmid of *Agrobacterium tumifaciens* has now been modified into a cloning vector which is no more pathogenic to the plants but is still able to use the mechanisms to deliver genes of our interest into a variety of plants

Agrobacterium causes crown gall



Animals –

- Retroviruses in animals have the ability to transform normal cells into cancerous cells.
- Similarly, retroviruses have also been disarmed and are now used to deliver desirable genes into animal cells.
- So, once a gene or a DNA fragment has been ligated into a suitable vector it is transferred into a bacterial, plant or animal host (where it multiplies).

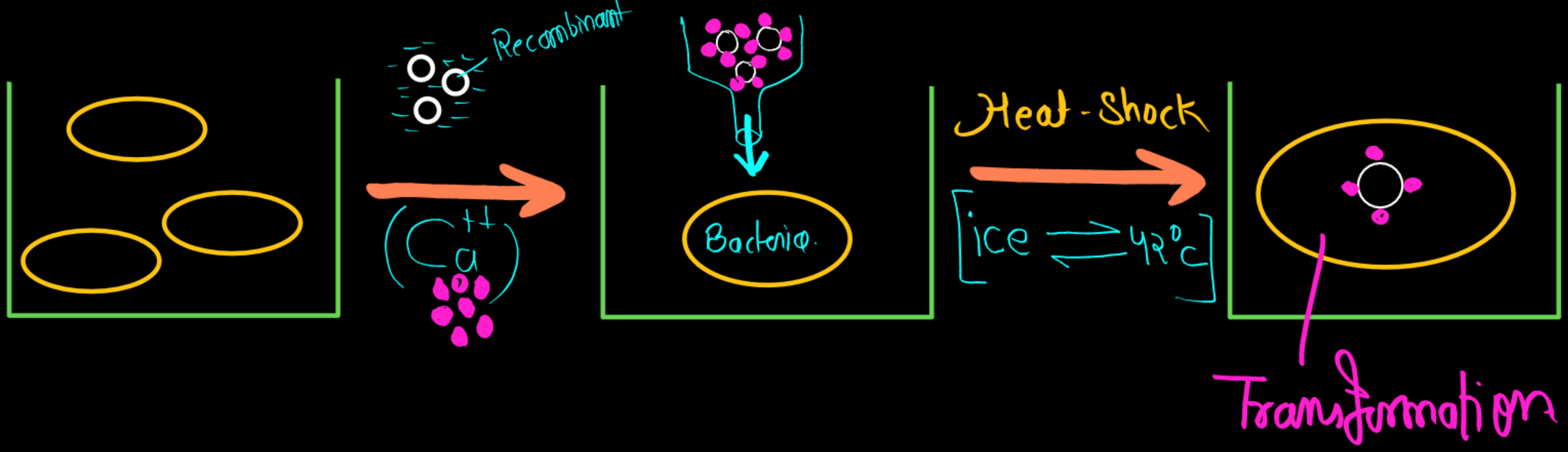
Ori of Prokaryote +nt
" " Eukaryote +nt

NOTE –

Shuttle vector – Replicate in both prokaryotic cell and eukaryotic cell. Eg. YEP and modified Ti plasmid

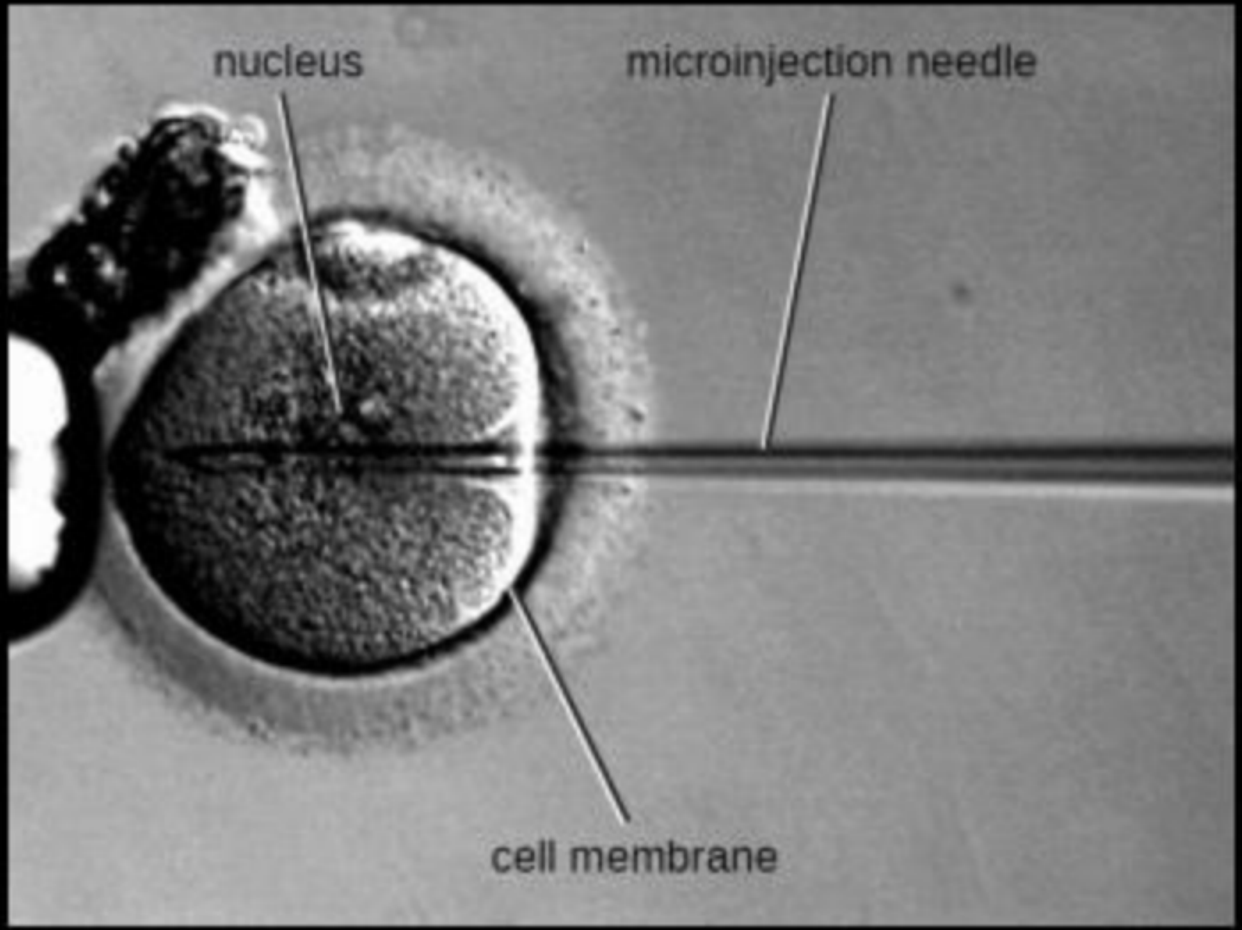
Competent Host (For Transformation with Recombinant DNA)

(1) Since DNA is a hydrophilic molecule, it cannot pass through cell membranes. This is done by treating them with a specific concentration of a divalent cation, such as calcium. Recombinant DNA can then be forced into such cells by incubating the cells with recombinant DNA on ice, followed by placing them briefly at 42oC (heat shock), and then putting them back on ice. This enables the bacteria to take up the recombinant DNA.



(2) Micro-injection

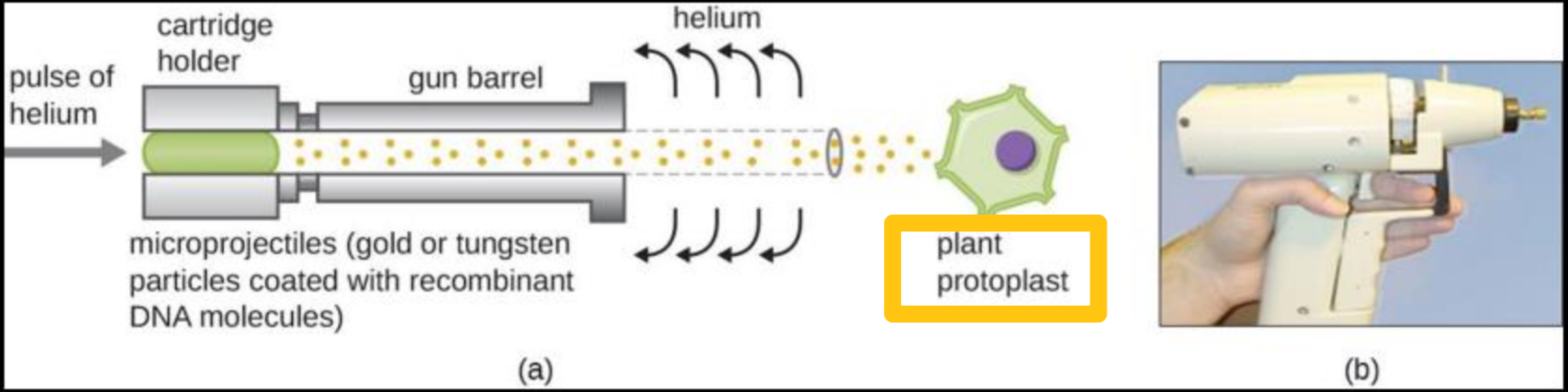
In a method known as micro-injection, recombinant DNA is directly injected into the nucleus of an animal cell.



(3) Biolistics or gene gun

In another method, suitable for plants cells are bombarded with high velocity micro-particles of gold or tungsten coated with DNA in a method known as biolistics or gene gun.

+ve charge



PROCESSES OF RECOMBINANT DNA TECHNOLOGY

Recombinant DNA technology involves several steps –

a) Isolation of DNA
b) Fragmentation of DNA by restriction endonucleases
c) Isolation of a desired DNA fragment by gel electrophoresis
d) Amplification of DNA fragment by PCR
e) Ligation of the DNA fragment into a vector
f) Transferring the recombinant DNA into the host
g) Culturing the host cells in a medium at large scale and extraction of the desired product.

(1) Isolation of the Genetic Material (DNA)

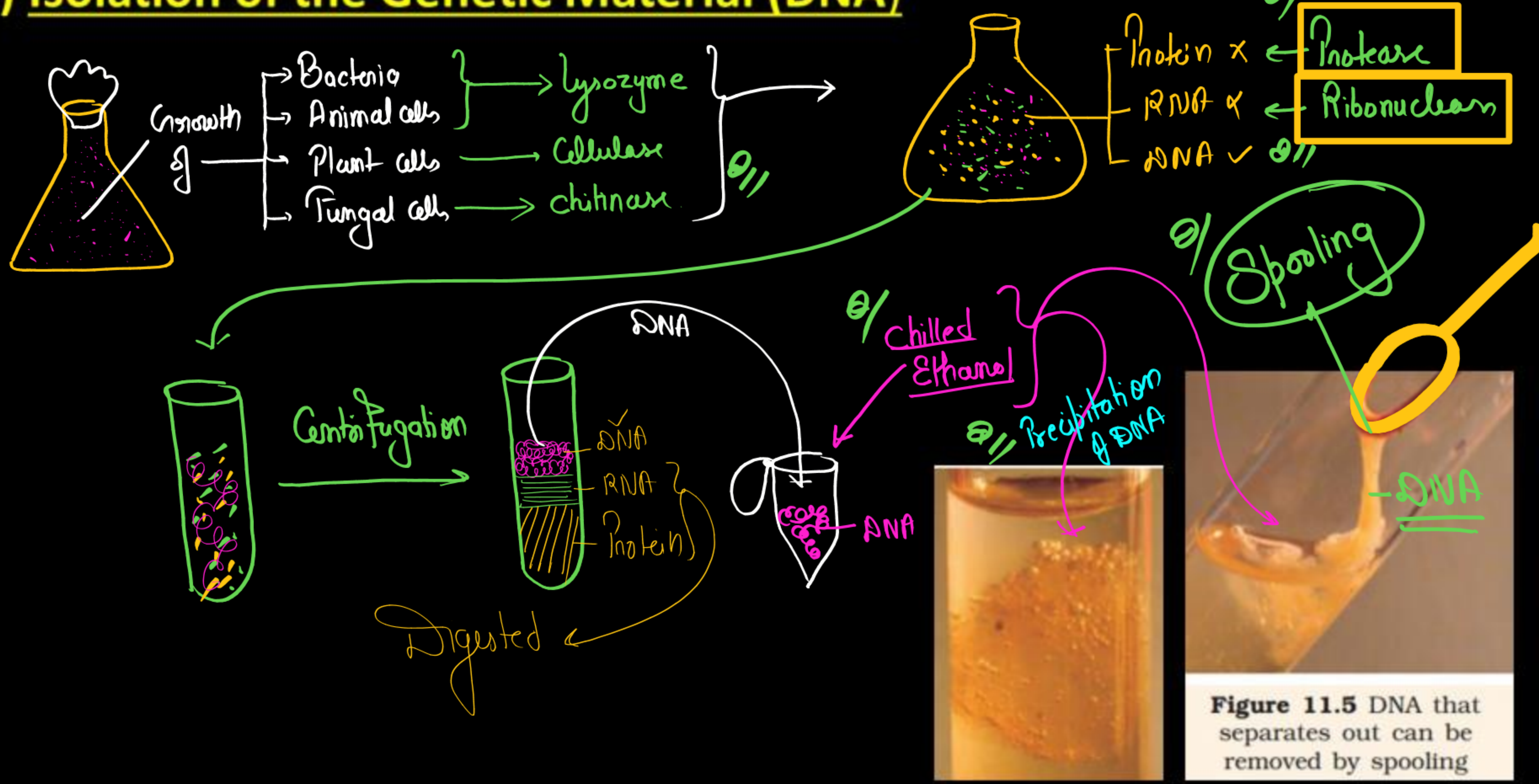
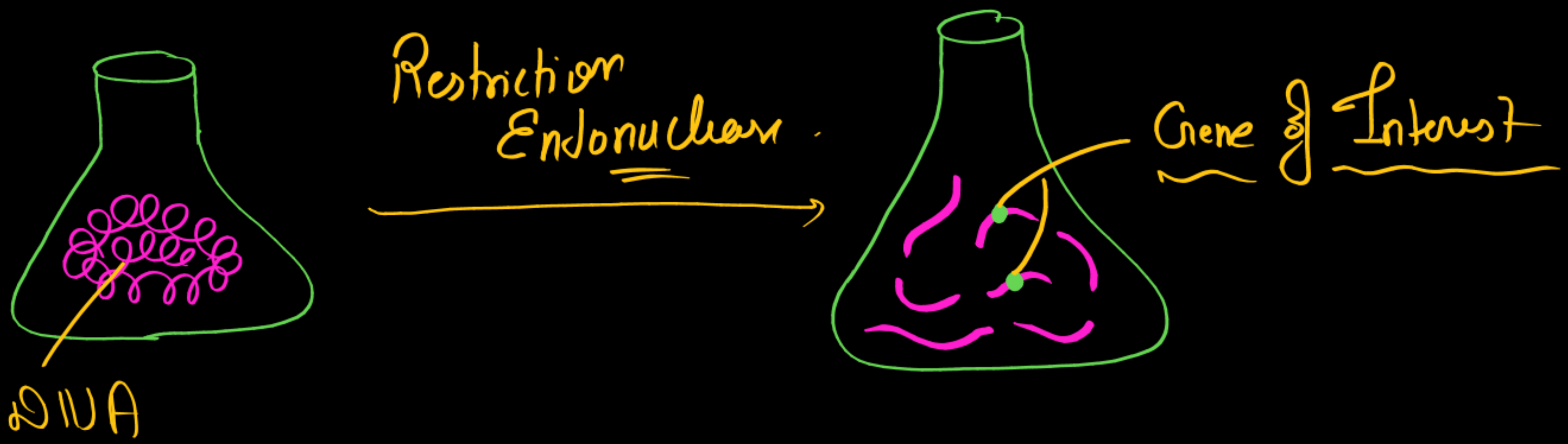


Figure 11.5 DNA that separates out can be removed by spooling

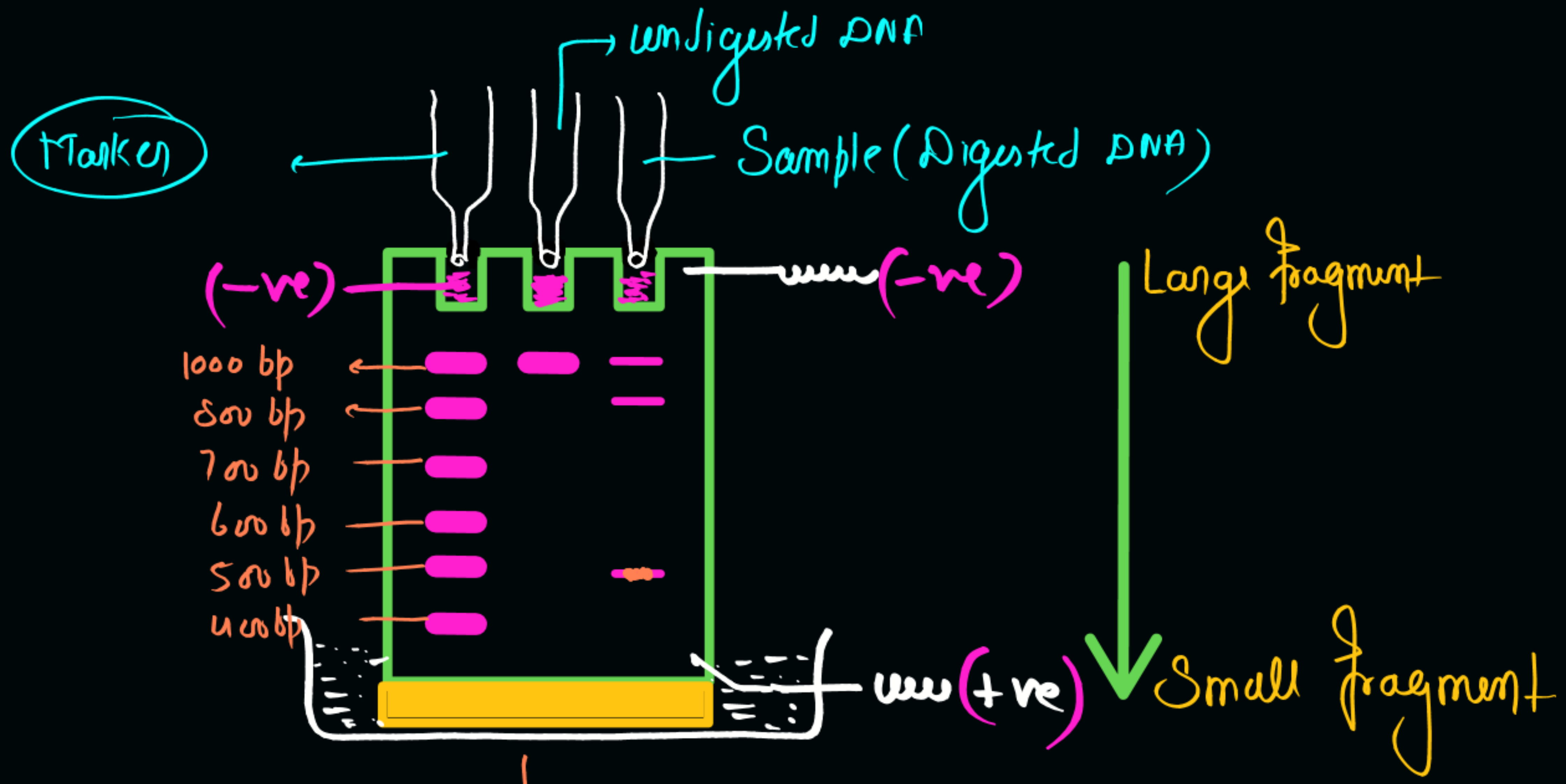
(2) Fragmentation of DNA by restriction endonucleases

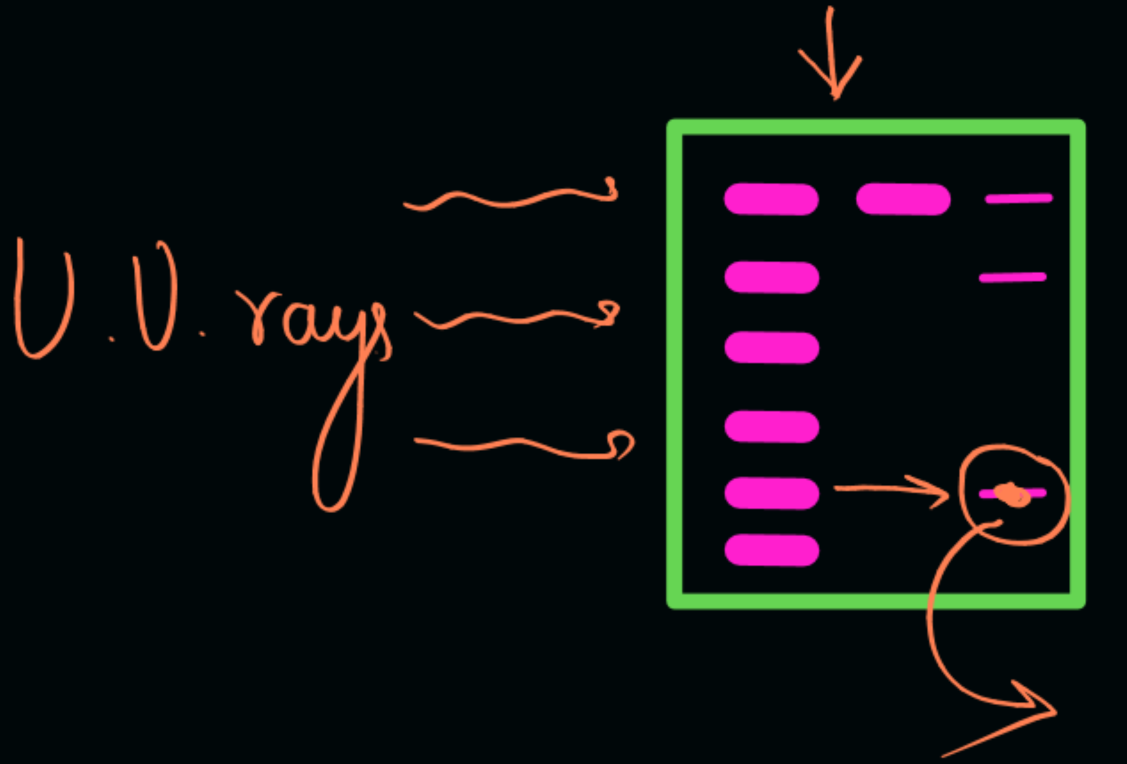


(3) Separation and Isolation of a desired DNA fragment by gel electrophoresis

- Since DNA fragments are negatively charged molecules they can be separated by forcing them to move towards the anode under an electric field through a medium/matrix.
- Nowadays the most commonly used matrix is agarose which is a natural polymer extracted from sea weeds (red algae).
- The DNA fragments separate (resolve) according to their size through sieving effect provided by the agarose gel. Hence, the smaller the fragment size, the farther it moves.





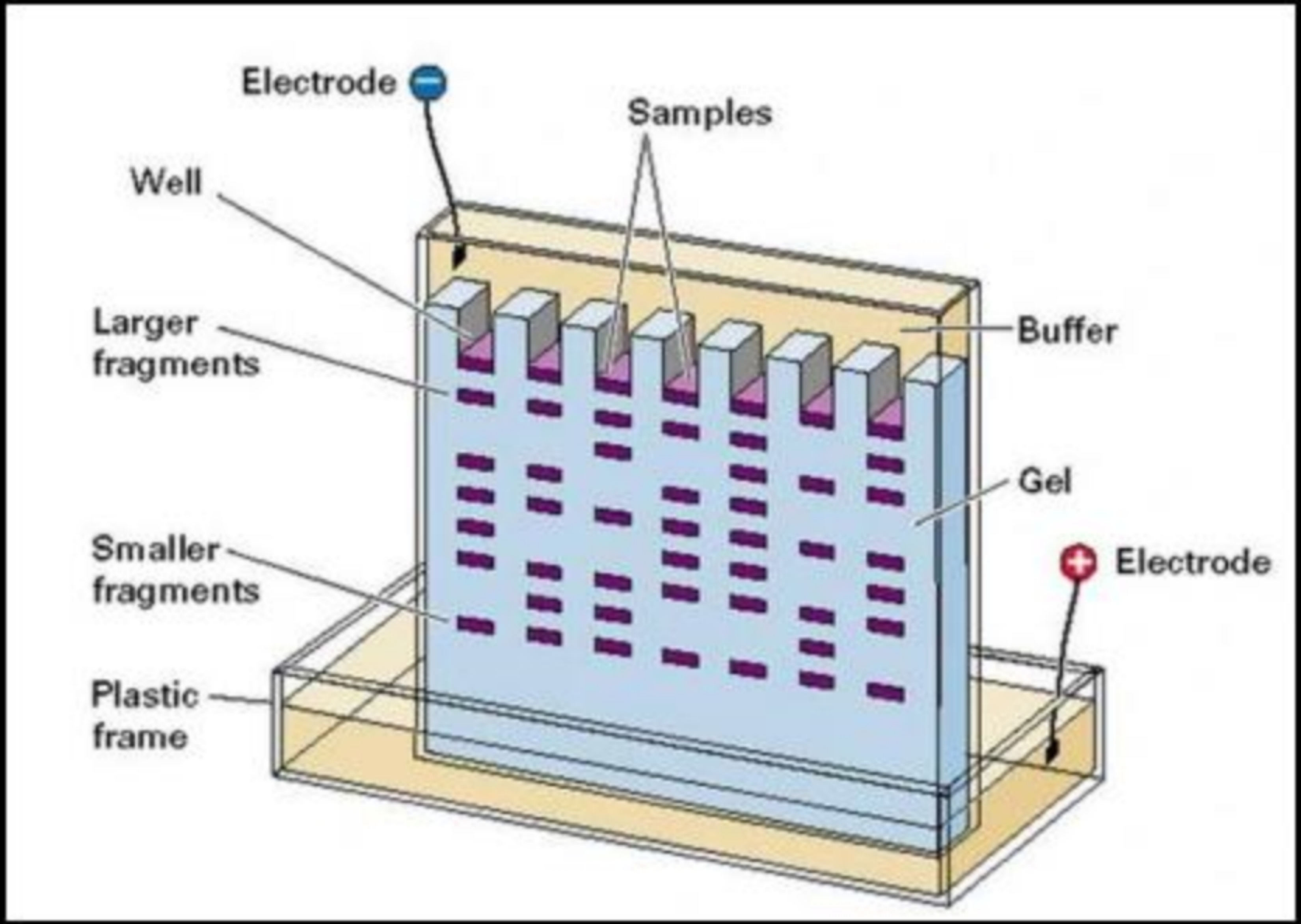


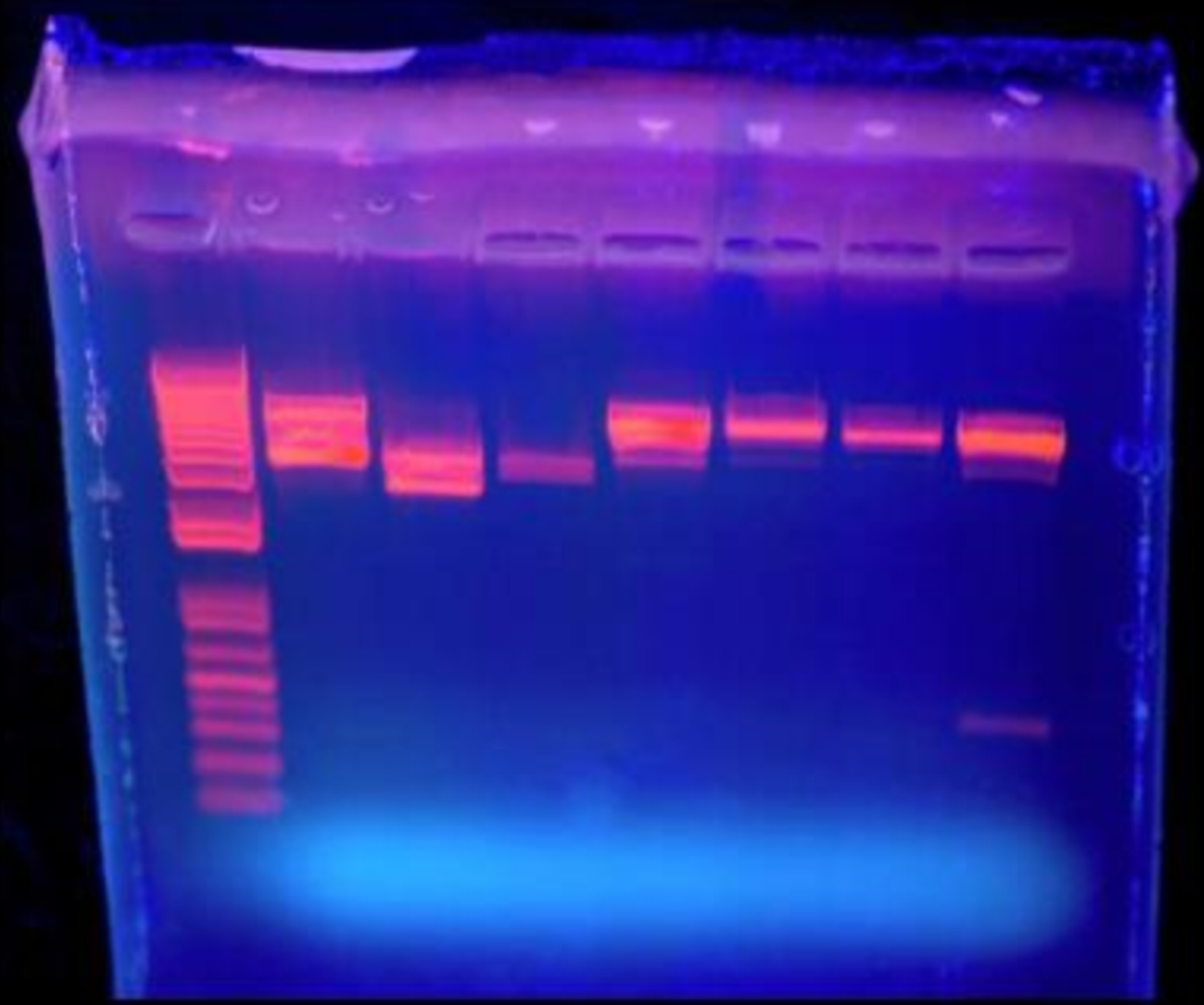
1) - Ethedium Bromide

2) - U.V. Radition

3) - Orange Colour bands of DNA.

- The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation.
- You can see bright orange coloured bands of DNA in a ethidium bromide stained gel exposed to UV light.
- The separated bands of DNA are cut out from the agarose gel and extracted from the gel piece. This step is known as elution.


Electrode
Samples
Well
Larger
fragments
Buffer
Gel
Smaller
fragments
Electrode
Plastic
frame



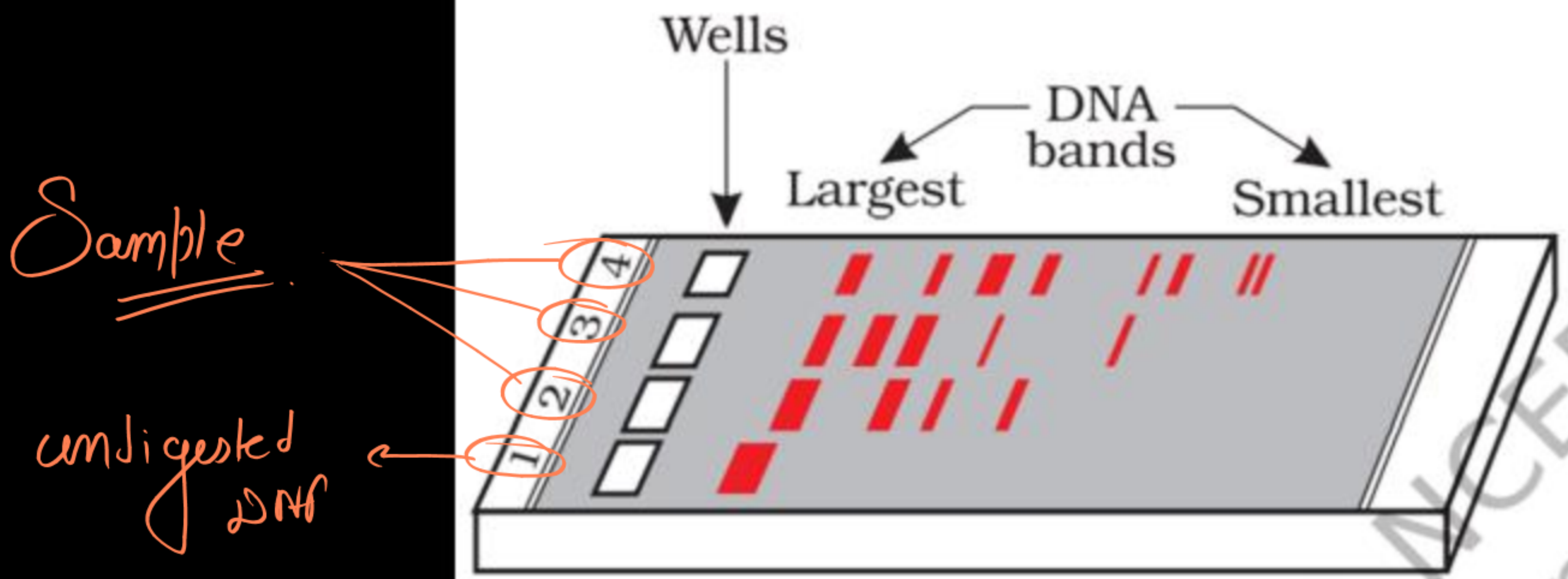
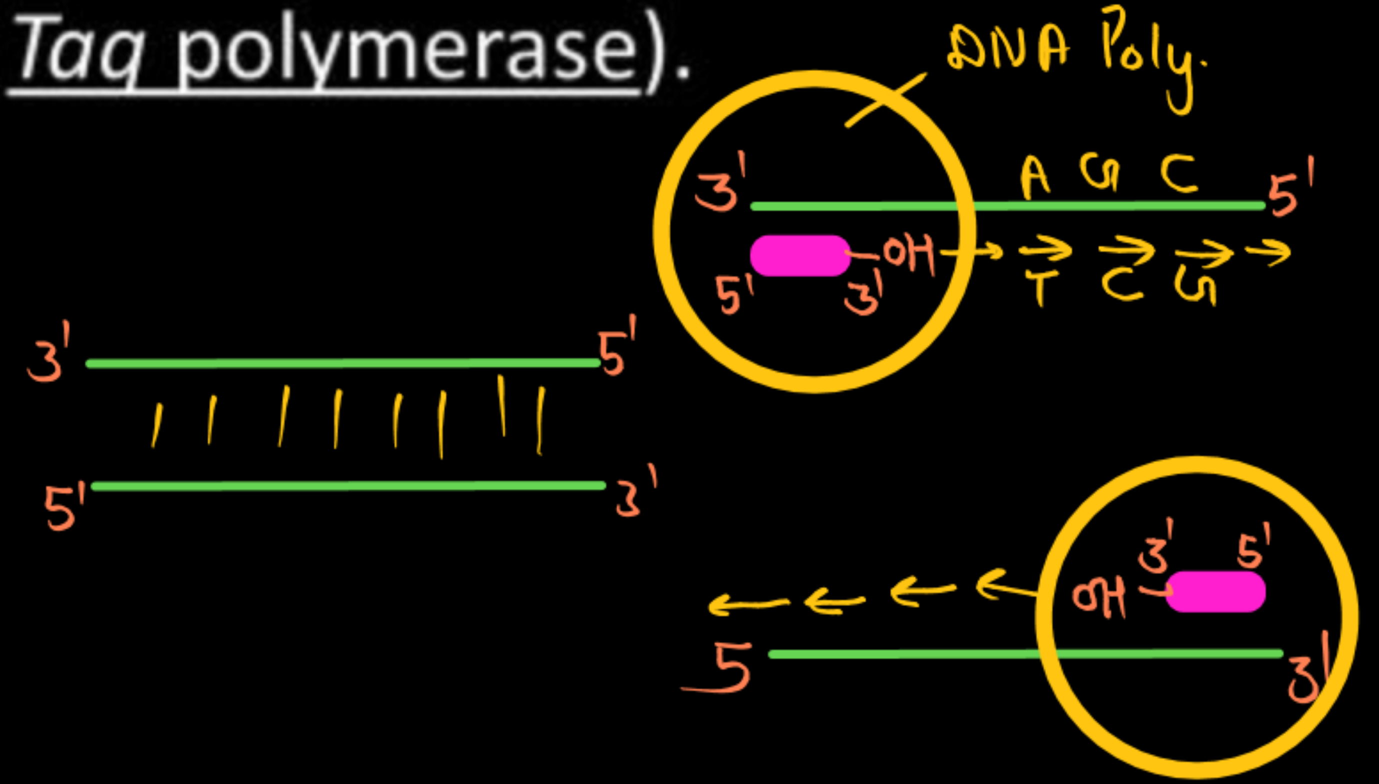


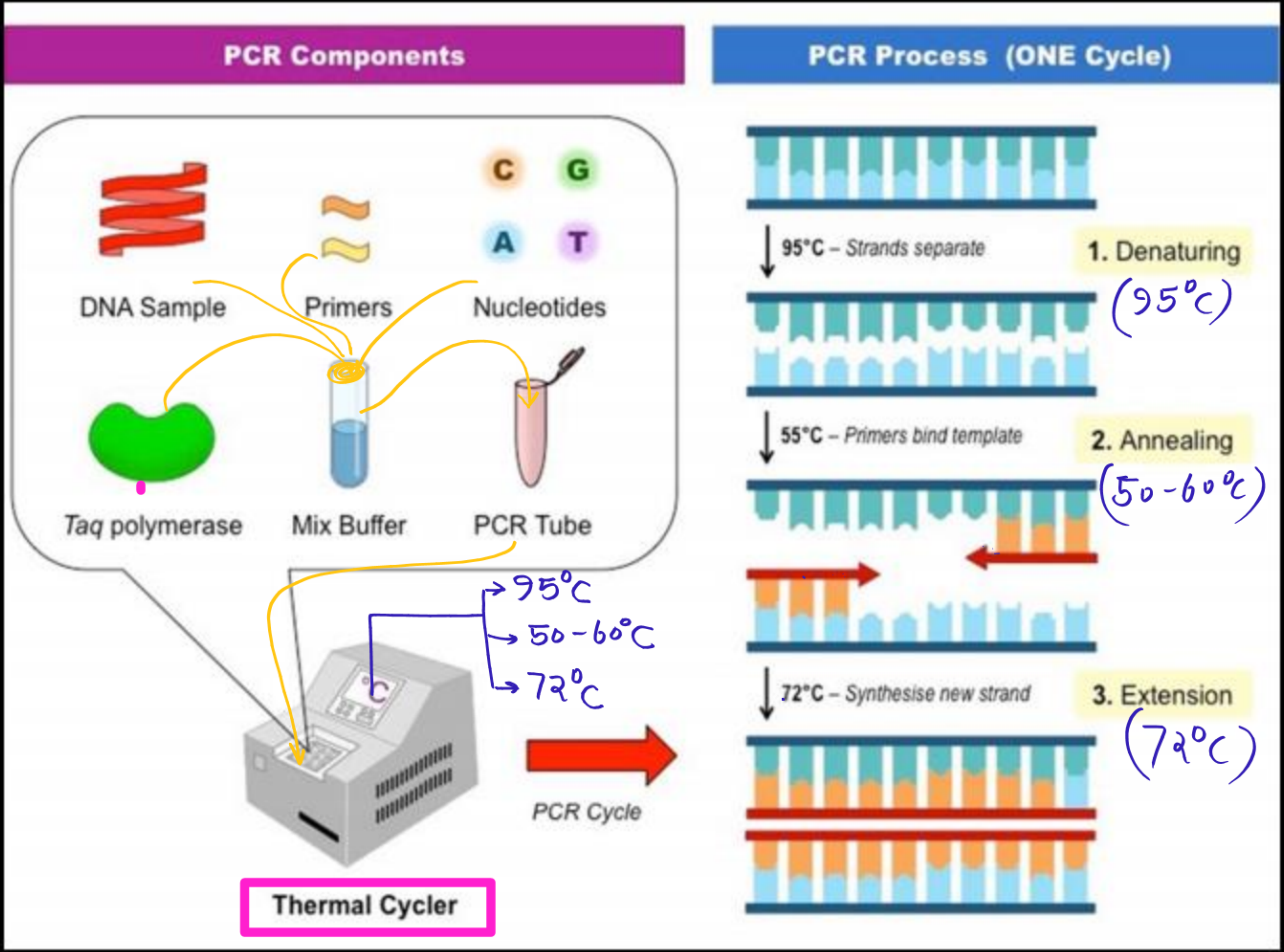
Figure 11.3 A typical agarose gel electrophoresis showing migration of undigested (lane 1) and digested set of DNA fragments (lane 2 to 4)

(4) Amplification of DNA fragment by using PCR

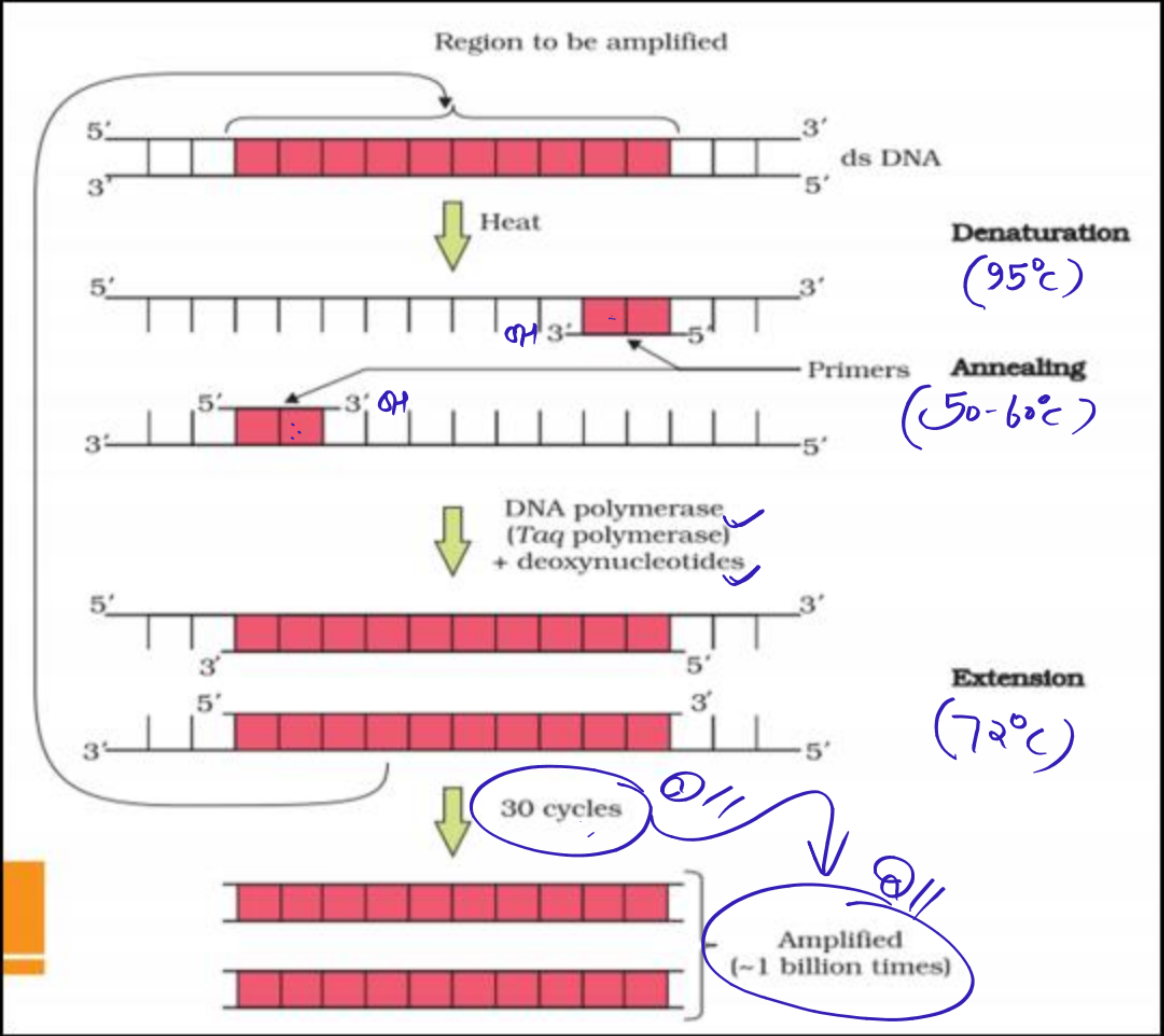
PCR stands for Polymerase Chain Reaction. In this reaction, multiple copies of the gene (or DNA) of interest is synthesised in vitro using –

1. Two sets of primers (small chemically synthesised oligonucleotides that are complementary to the regions of DNA)
2. Thermostable DNA polymerase (isolated from a bacterium, Thermus aquaticus so it is called *Taq polymerase*).
3. dNTPs + Mg ions
4. DNA sample





PCR Components
PCR Process (ONE Cycle)
C
G
A
T
DNA Sample
Primers
Nucleotides
Taq polymerase
Mix Buffer
PCR Tube
°C
95°C
50-60°C
72°C
Thermal Cycler
PCR Cycle
95°C – Strands separate
1. Denaturing
(95°C)
55°C – Primers bind template
2. Annealing
(50-60°C)
72°C – Synthesise new strand
3. Extension
(72°C)



Region to be amplified
5′
3′
3′
5′
ds DNA
Heat
Denaturation
(95°C)
5′
3′
OH 3′
5′
Primers
Annealing
(50-60°C)
5′
3′ OH
3′
5′
DNA polymerase
(Taq polymerase)
+ deoxynucleotides
5′
3′
3′
5′
Extension
(72°C)
5′
3′
3′
5′
30 cycles
Amplified
(~1 billion times)

(5) Insertion of Recombinant DNA into the Host Cell/Organism

- There are several methods of introducing the ligated DNA into recipient cells.
- So, if a recombinant DNA bearing gene for resistance to an antibiotic (e.g., ampicillin) is transferred into *E. coli* cells, the host cells become transformed into ampicillin-resistant cells.
- If we spread the transformed cells on agar plates containing ampicillin, only transformants will grow, untransformed recipient cells will die.
- Since, due to ampicillin resistance gene, one is able to select a transformed cell in the presence of ampicillin. The ampicillin resistance gene in this case is called a selectable marker.

(6) Obtaining the Foreign Gene Product (Recombinant protein) -

Bioreactors –

- Small volume cultures cannot yield appreciable quantities of products.
- To produce in large quantities, the development of bioreactors, where large volumes (100-1000 litres) of culture can be processed, was required.
- A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions (temperature, pH, substrate, salts, vitamins, oxygen).

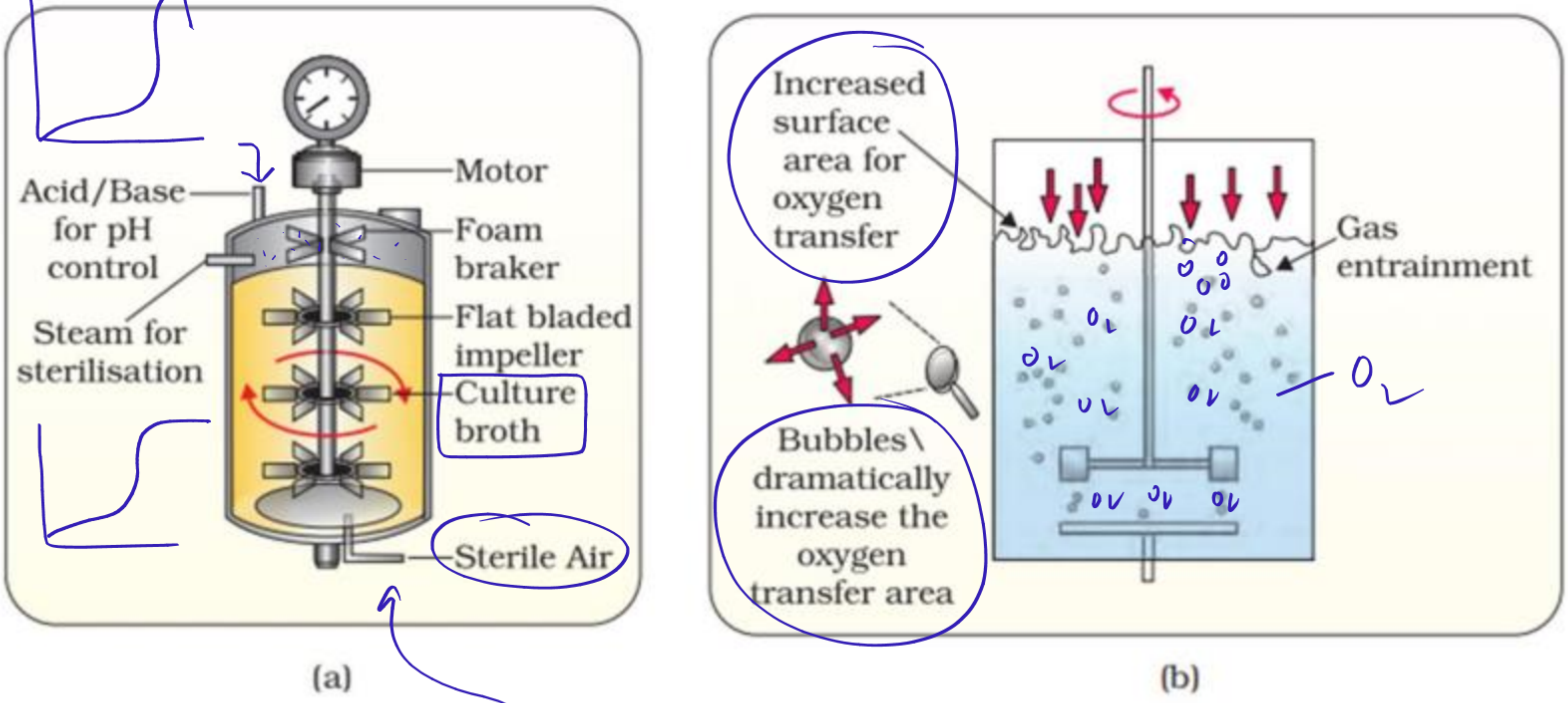


Figure 11.7 (a) Simple stirred-tank bioreactor (b) Sparged stirred-tank bioreactor through which sterile air bubbles are sparged

Downstream Processing

The processes include = Separation and Purification of Product

During gel electrophoresis for separation of DNA fragments

(1) Smallest fragment will move to the farthest point towards cathode

(2) Smallest fragment will move to the farthest point towards anode

(3) Largest fragment will move to the farthest point towards cathode

(4) Largest fragment will move to the farthest point towards anode

After electrophoresis, the separated DNA fragment can be visualised in ethidium bromide stained gel exposed to UV light. These DNA fragments appear as ________ coloured bands.

(1) Orange

(2) Blue

(3) Silver

(4) Green

An antibiotic resistance gene in a vector helps in selection of

(1) Competent cells
(2) Transformed cells
(3) Recombinant cells
(4) Both (2) & (3)

During the process of isolation of DNA, chilled ethanol is added to

(1) Remove proteins such as histones
(2) Precipitate DNA
(3) Break open the cell to release DNA
(4) Facilitate action of restriction enzymes

Function of ‘ori’ site in a vector is to

(1) Initiate insertional inactivation
(2) Initiate replication
(3) Codes for the proteins involved in replication of the plasmid
(4) Initiate antibiotic resistance

The ability to transform normal cells into cancerous cells is found in

(1)Ti plasmid
(2) Retrovirus
(3) All plasmids
(4) Both (1) & (2)

Which of the following is not a method of introducing alien DNA into host cells?

(1) Micro injection
(2) Heat shock method
(3) Being placed along with the cell into a gene gun
(4) Gel electrophoresis

Although the Ti plasmid has revolutionised plant genetic engineering one limitation of its use is that it

(1) Cannot infect broad leaf plants
(2) Cannot be used on fruit-bearing plants
(3) Cannot transmit prokaryotic genes
(4) Does not infect cereal plants such as corn and rice

The correct order of steps in Polymerase Chain Reaction (PCR) is [NEET-2018]

(1) Denaturation, Extension, Annealing

(2) Annealing, Extension, Denaturation

(3) Extension, Denaturation, Annealing

(4) Denaturation, Annealing, Extension

The process of separation and purification of expressed protein before marketing is called.

(1) downstream processing [NEET-2017]

(2) bioprocessing

(3) postproduction processing

(4) upstream processing

Downstreaming process in biotechnology refers to

(1) The process which includes separation and purification of the product, after the completion of the biosynthetic stage

(2) Large scale production of a product, by using bioreactors

(3) The cells harbouring cloned genes of intersect, being grown on a small scale

(4) The microbes which act upon the substrate are cultured and added into the fermenter

Which of the following is a **true** statement regarding DNA polymerase used in PCR?

(1) It is isolated from a virus

(2) It remains active at high temperature

(3) It is used to ligate introduced DNA in recipient cells

(4) It serves as a selectable marker

Which of the following is correct sequence of step PCR or polymerase chain reaction?

(1) Denaturation → Annealing → Extension

(2) Extension → Denaturation → Annealing

(3) Annealing → Extension → Denaturation

(4) Denaturation → Extension → Annealing

THANK YOU !!

MANTHAN NEET

EVOLUTION

LECTURE - 2

ZOOLOGY



MD SIR

TODAY'S GOAL

- ❑ Evidence in favour of evolution

Origin of Prokaryotic Cells →

Protobionts →
- RNA
- Protein
- Lipid
- Carbohy.

↓

Prokaryotic Cells → [2 - B.Y.A]

1) - Chemoheterotroph → Fermentation of Organic Molecules → Energy

↓

2) - Chemoautotroph → Chemical Reaction → Energy

eg - Iron bacteria

↓

3) → Simple photoautotroph →
- Pigments +nt
- Source of Energy = light
- Source of $\bar{e}$ = H_2S

eg - Sulphur bacteria

4) → Photoautotroph → Source of $\bar{e}$ = $2H_2O \xrightarrow[\bar{e}]{} O_2 + 4H^+$

eg - Cyanobacteria (B.G.A)

Cynobacteria (B.G.A.) → $2H_2O \rightarrow O_2 + 4H^+$ (oxidising Atm.)

$$2O_2 + CH_4 \xrightarrow{O_2} CO_2 + 2H_2O$$

$$3O_2 + 4NH_3 \xrightarrow{O_2} 2N_2 + 6H_2O$$

oxidising



$$O_2 + 2O_2 \rightarrow 2O_3$$

↓

Origin of Eukaryotic cells

Evidences in favour of Evolution

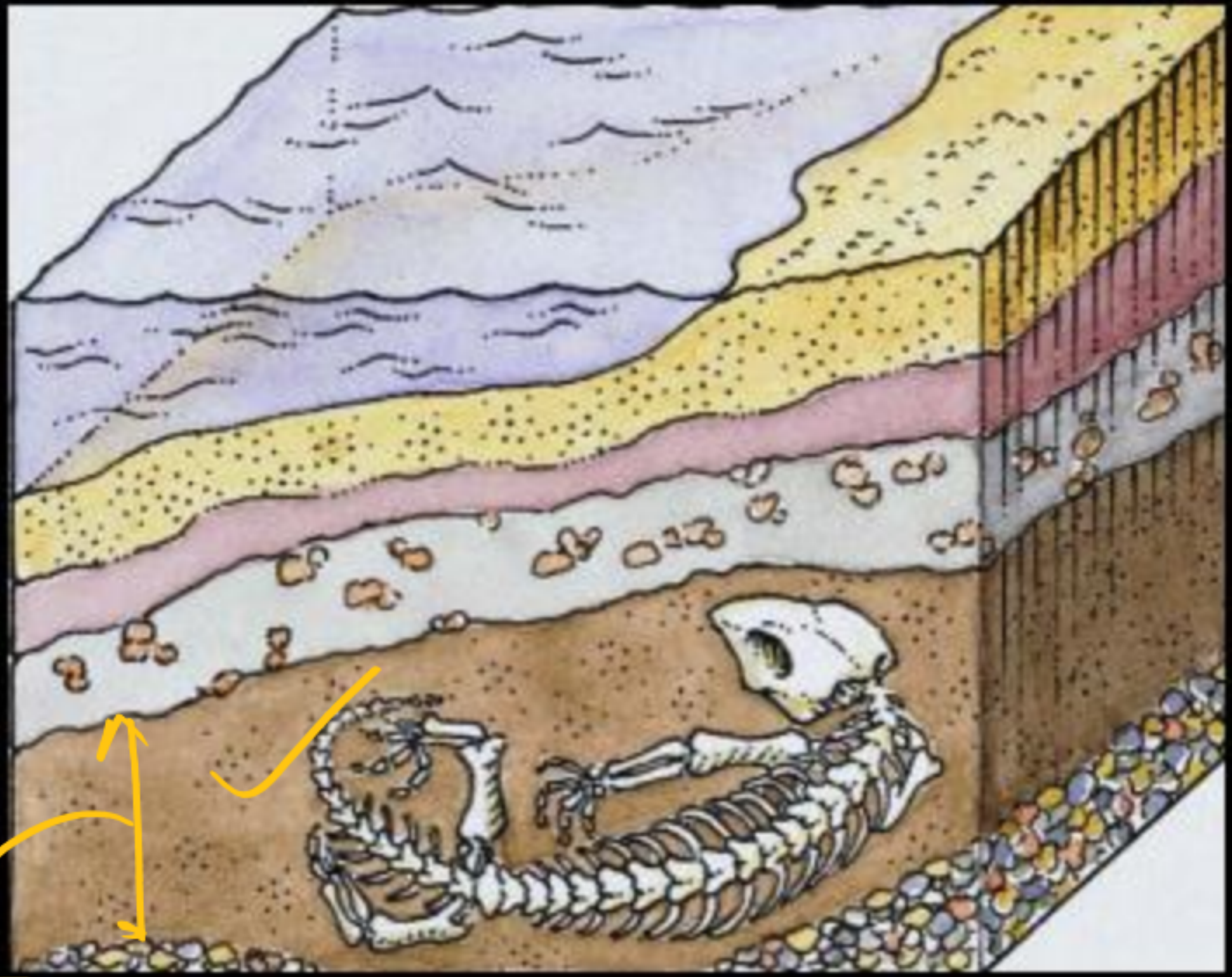
1) Palaeontological Evidences (Evidences from Fossil Record)
2) Evidences from Comparative Anatomy and Morphology vvvImp
3) Embryological Evidences (Evidences from Embryology)
4) Evidences from Physiology and Biochemistry

(1) Palaeontological Evidences (Evidences from Fossil Record)

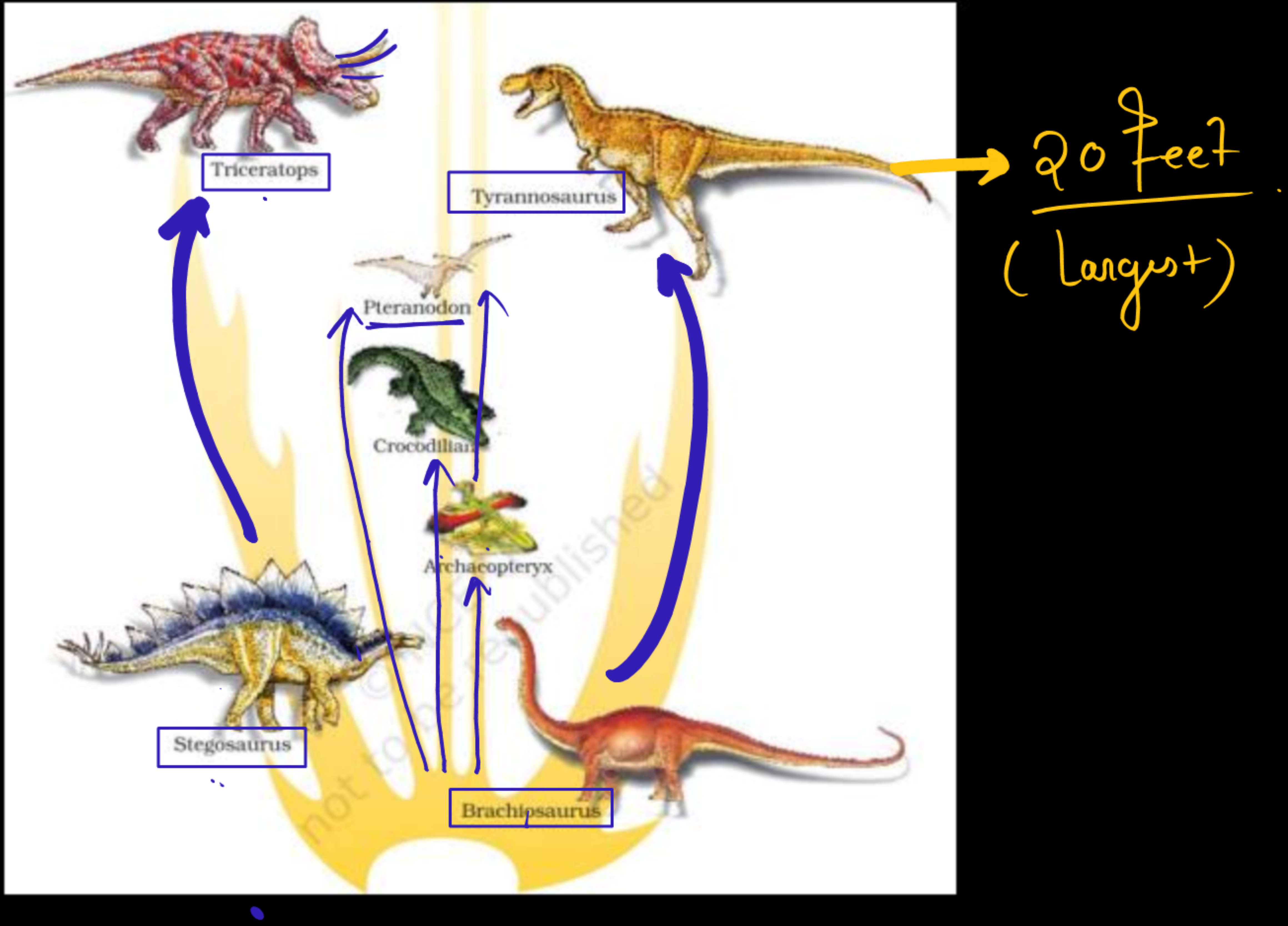
Paleontology – Study of fossils.

Fossils - Fossils are remains of hard parts of life-forms found in rocks.

Rocks form sediments and a cross-section of earth's crust indicates the arrangement of sediments one over the other during the long history of earth. They represent extinct organisms (e.g., Dinosaurs).

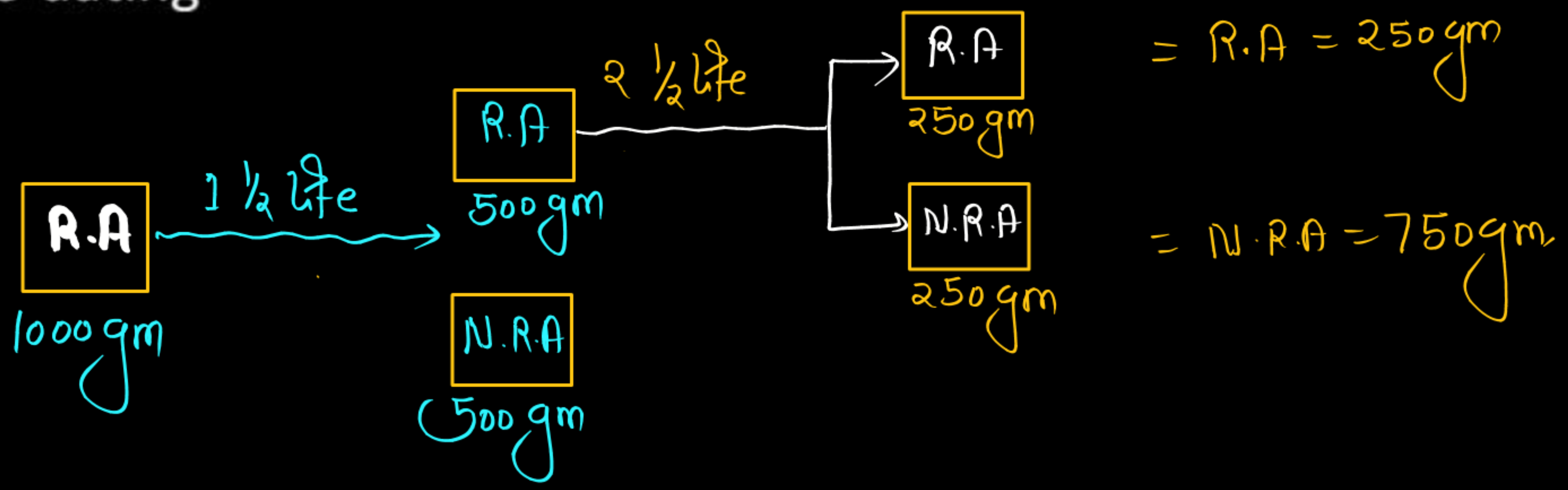


Age


Triceratops
Tyrannosaurus
Pteranodon
Crocodilian
Archaeopteryx
Stegosaurus
Brachiosaurus
20 feet
(Largest)

Ages of the Fossils/Rocks

(1) Radioactive-dating



Ratio of Radioactive & Non Radioactive =

In 1st ½ life = 1 : 1 = 1

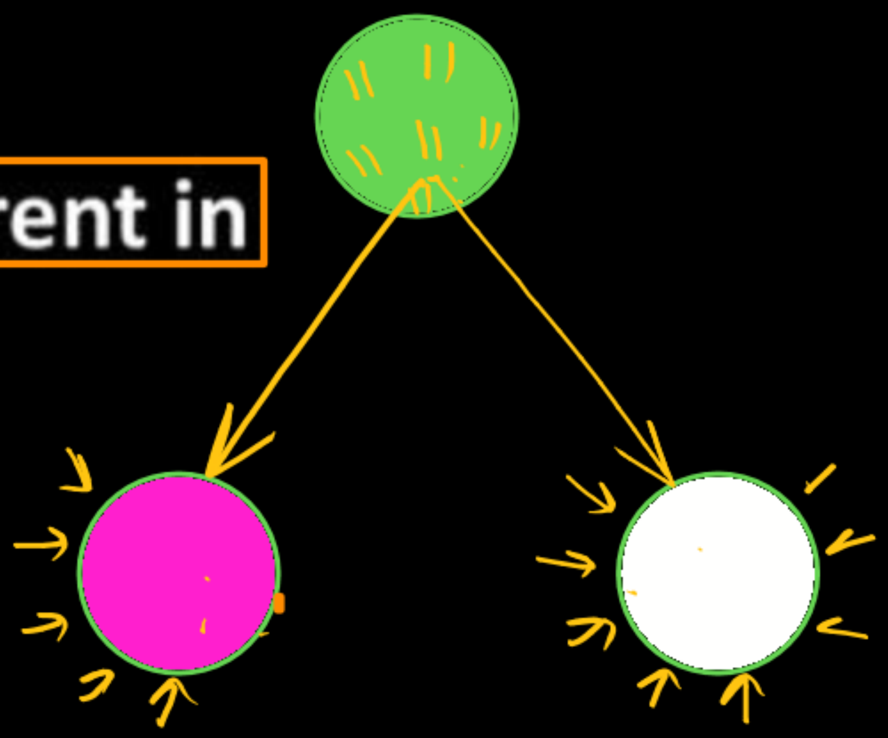
2nd ½ life = 1 : 3 = 2

eg → $C^{14} \xrightarrow[\text{5760 Year.}]{\text{one } 1/2 \text{ life}} N^{14}$

Imp

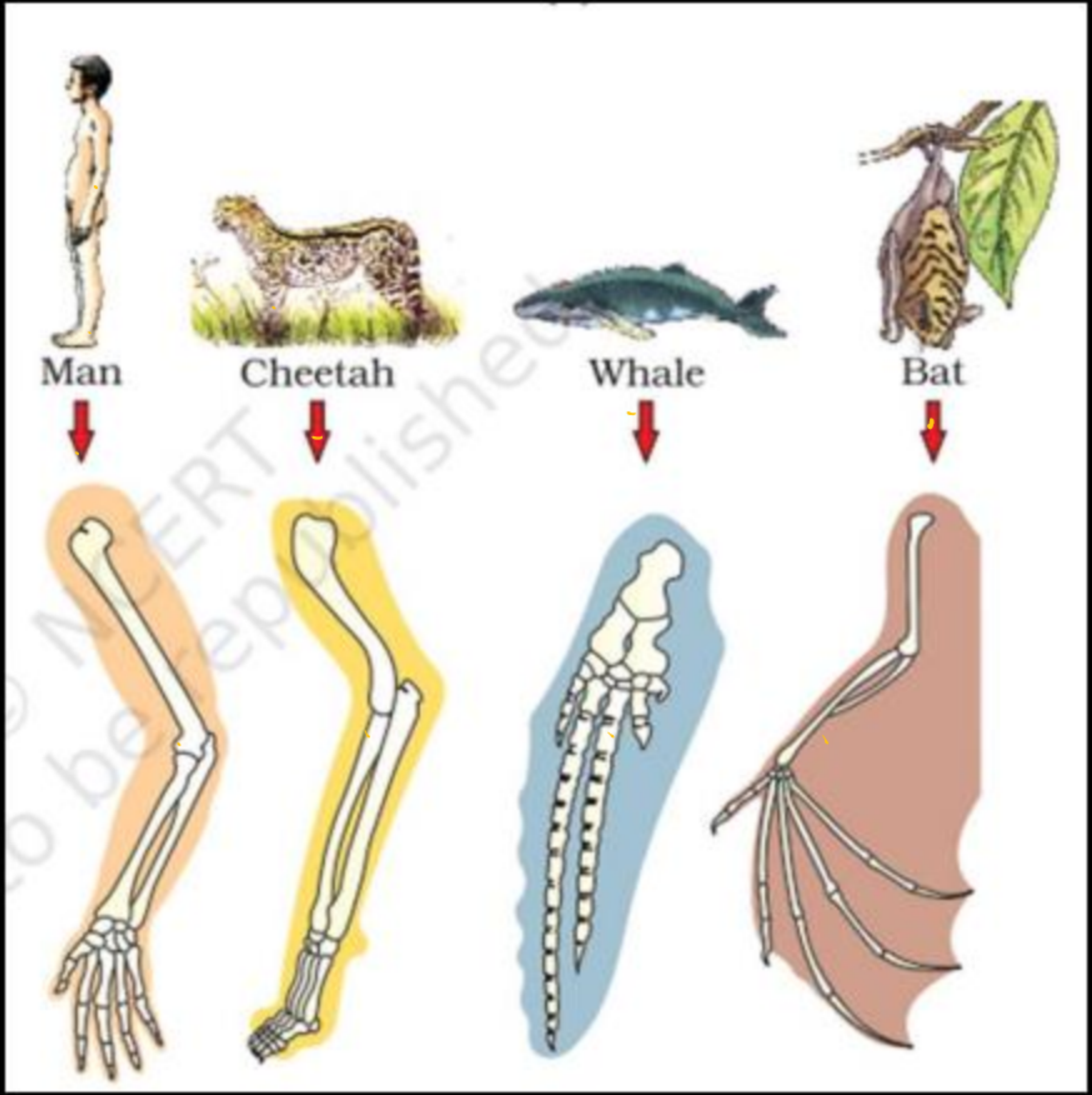
(2) Evidences from Comparative Anatomy and Morphology

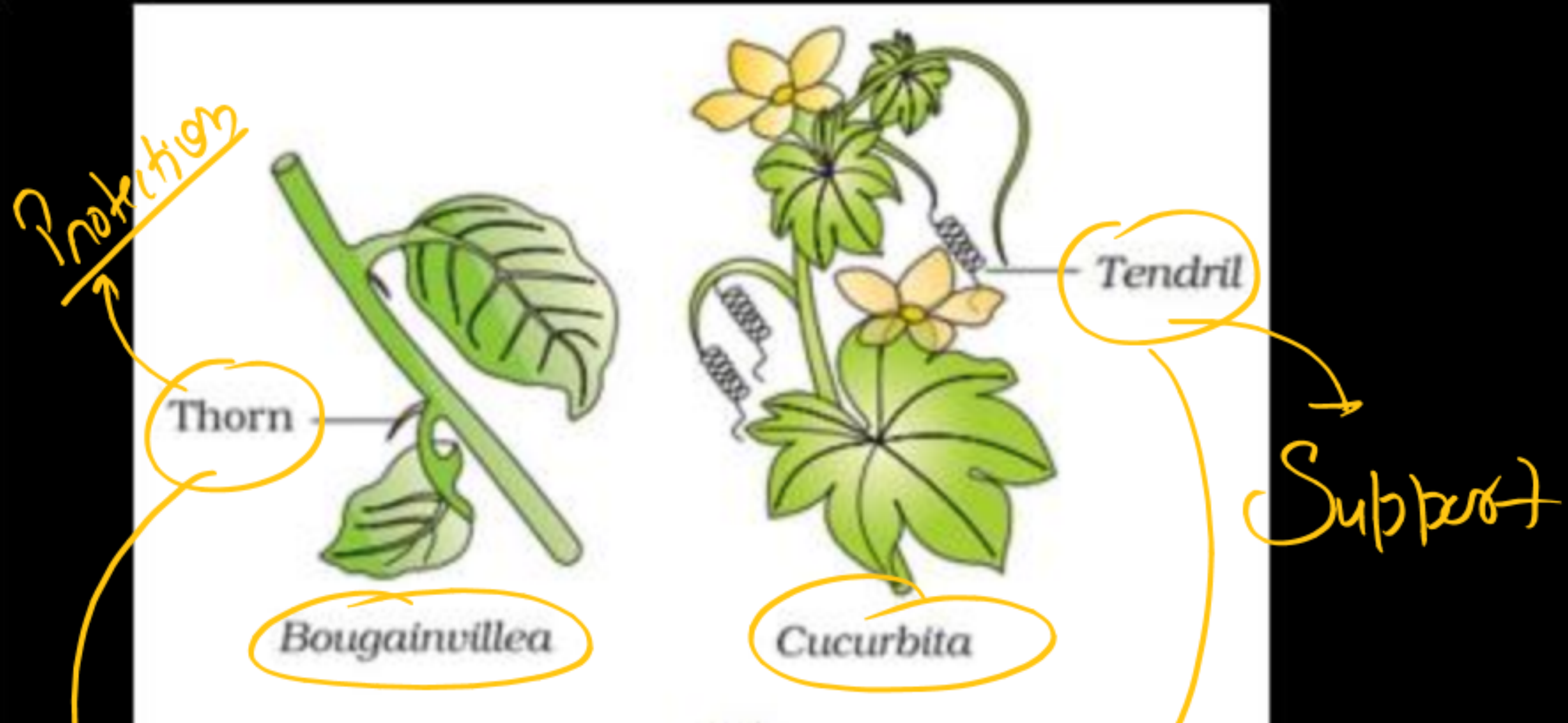
Homologous organs-



- Similar fundamental structure but are different in functions
- Divergent evolution
- Common ancestry
- Eg.-

1. Forelimbs of man, cheetah, whale and bat.
2. The mouth parts of cockroach, honey bee, mosquito and butterfly.
3. Thorn and tendrils of *Bougainvillea* and *Cucurbita* represent homology

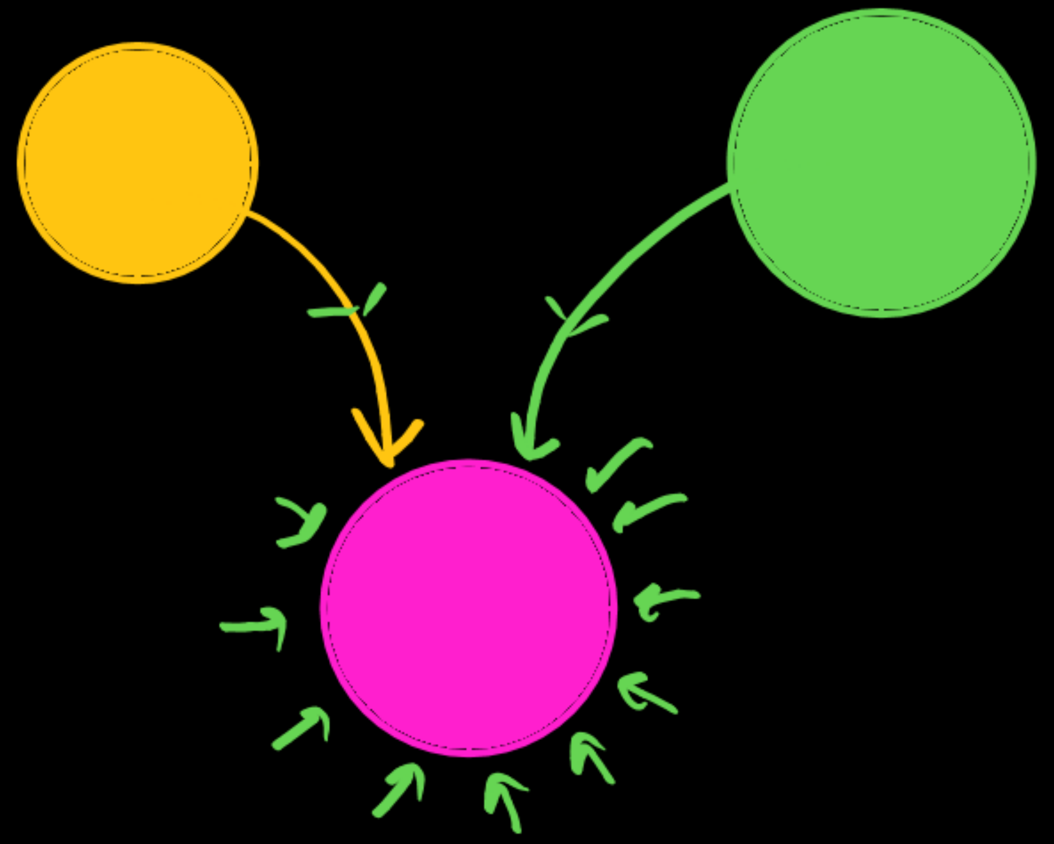




(a)

Axillary Growth

Analogous Organs



- Different their anatomical structural but
- Similar in functions due to same needs.
- Result of convergent evolution
- Eg.-

1. Wings of butterfly and of birds
2. Pectoral Fins of sharks and flippers of Dolphins
3. Stings of honey bee and scorpion
4. Eye of octopus and eye of mammals
5. Sweet potato (root modification) and potato (stem modification)

(3) Vestigial Organs

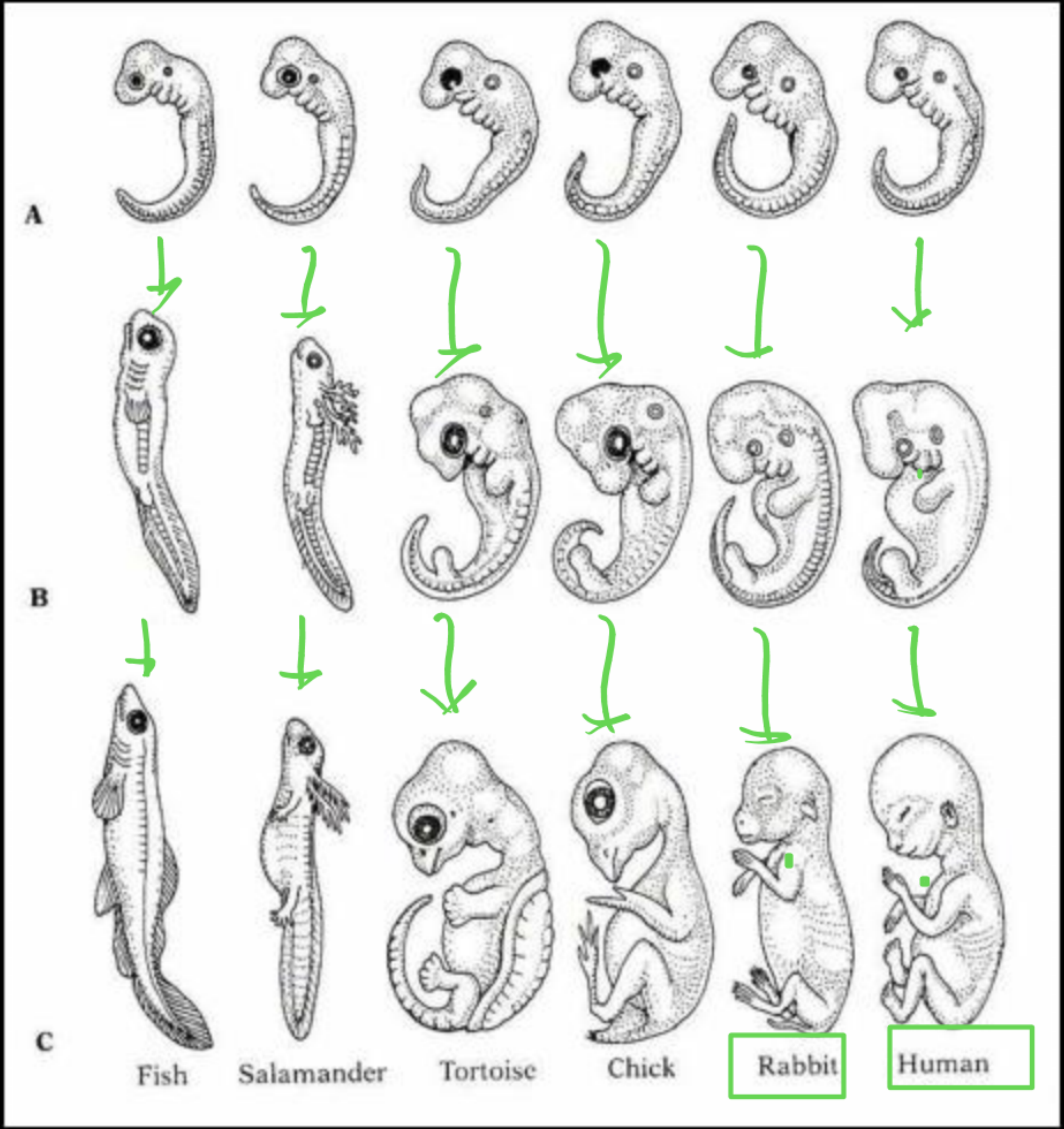
The organs which are present in reduced form and do not perform any function in the body but correspond to the fully developed functional organs of related animals are called vestigial organs.

Eg- Vestigial Organs in Human Body

- Nictitating membrane (plica semilunaris)
- Auricular muscles of ear
- Segmental muscles of abdomen
- Vermiform appendix
- Coccyx or tailbone
- Third molars (wisdom teeth)
- Nipples in male

(5) Embryological Evidences (Evidences from Embryology)

- Embryological support for evolution was also proposed by **Heckel** based upon the observation of certain features during embryonic stage common to all vertebrates that are absent in adult.
- For example, the embryos of all vertebrates including human develop a row of vestigial gill slit just behind the head but it is a functional organ only in fish and not found in any other adult vertebrates. However, this proposal was disapproved on careful study performed by **Karl Ernst von Baer**. He noted that embryos never pass through the adult stages of other animals
- Biogenic Law - According to Hackel – Ontogeny (development of embryo) recapitulates plylogeny.

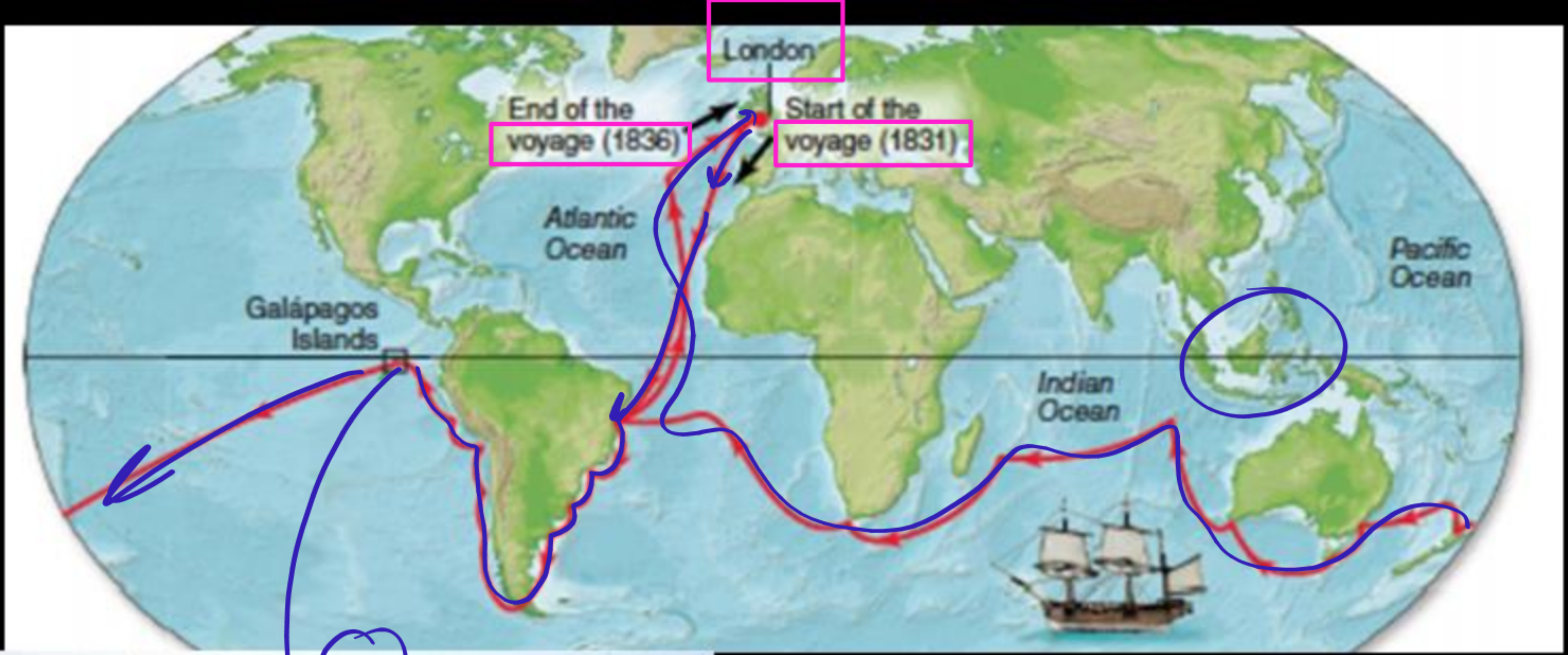

A
B
C
Fish
Salamander
Tortoise
Chick
Rabbit
Human

(5) Evidences from Physiology and Biochemistry

- Similarities in proteins and genes performing a given function among diverse organisms give clues to common ancestry.
- Eg.
  - Trypsin Enzyme → Mostly Invertebrate.
    → Vertebrate.
  - Pepsin Enzyme → Vertebrate.

ADAPTIVE RADIATION –

- During his journey (1831) Darwin went to Galapagos Islands - 22.
- Ship - "H.M.S. Beagle
- Duration of journey 5 years.

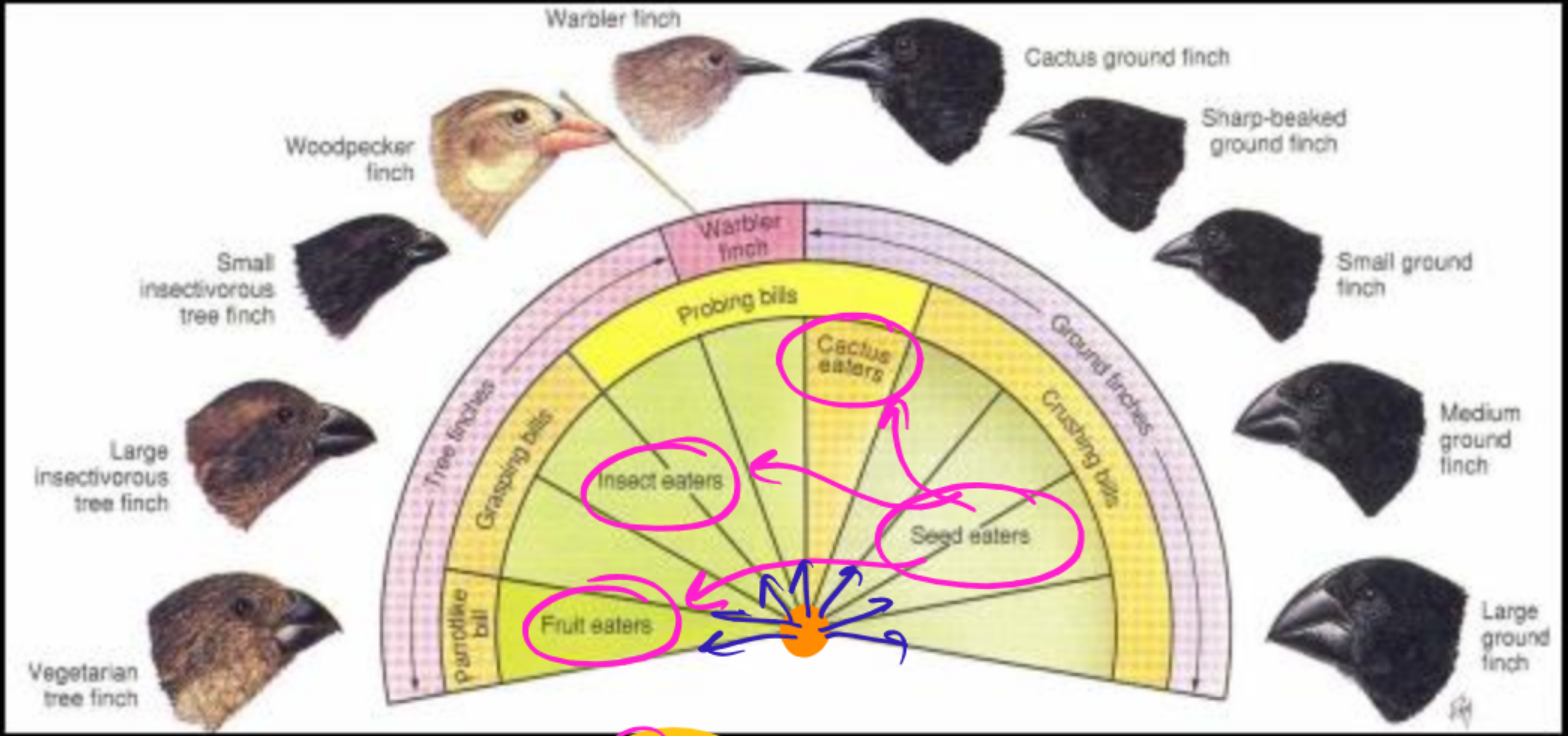

London
End of the voyage (1836)
Start of the voyage (1831)
Atlantic Ocean
Pacific Ocean
Galápagos Islands
Indian Ocean

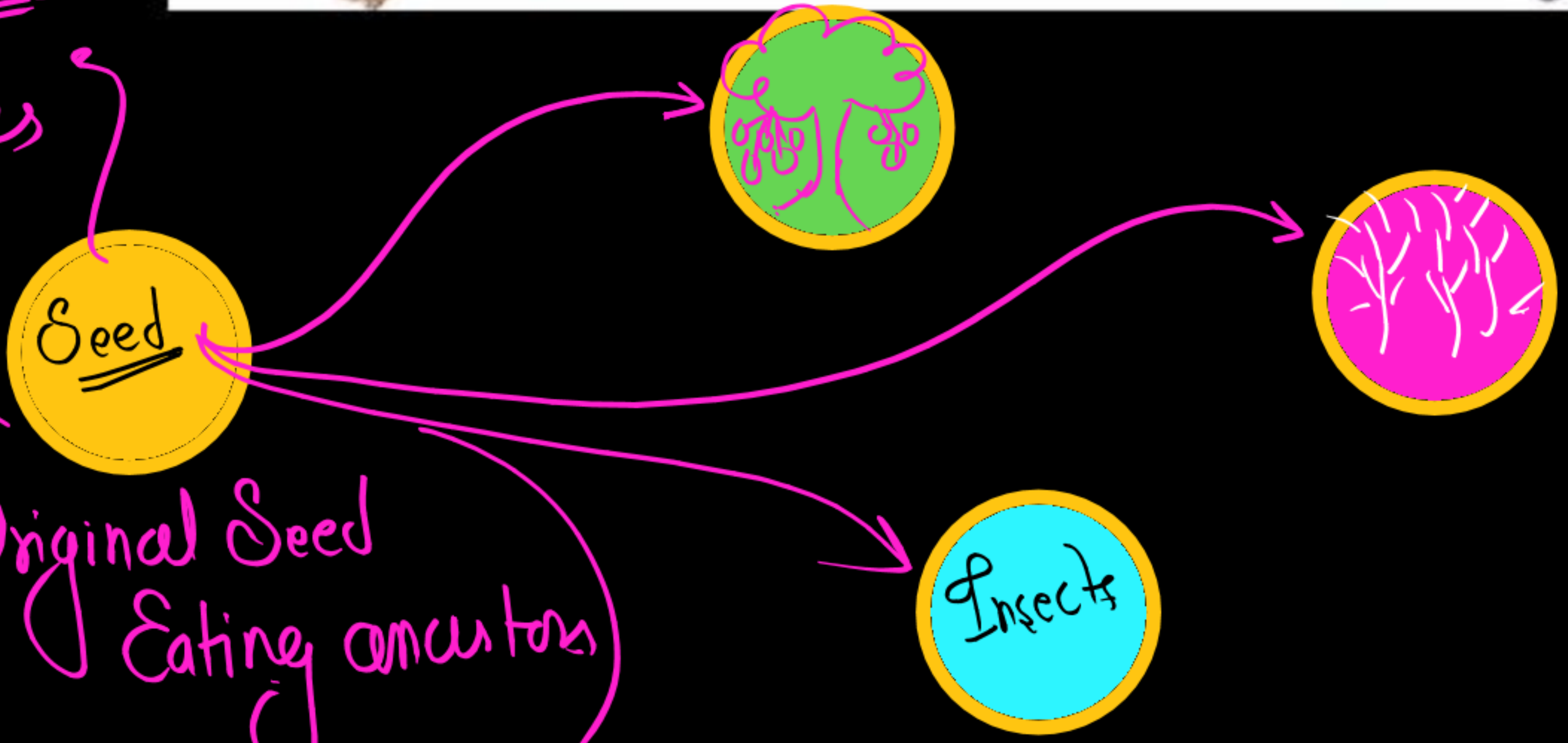

ABINGDON
BINDLOE
TOWER
JAMES
NARBOROUGH
JERVIS
BALTRA
DUNCAN
INDEFATIGABLE
BARRINGTON
ALBEMARLE
CHATHAM
CHARLES
HOOD

- There he observed an amazing diversity of creatures. Of particular interest, small black birds later called Darwin's Finches amazed him. He realised that there were many varieties of finches in the same island.
- All the varieties are evolved on the island itself. From the original seed-eating features, many other forms with altered beaks arose, enabling them to become insectivorous and vegetarian finches
- This process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation.
- Darwin's finches represent one of the best examples of this phenomenon. Another example is Australian marsupials and Placental mammals.

22-Islands

13-Finches





Original Seed Eating ancestors

Australian marsupials -

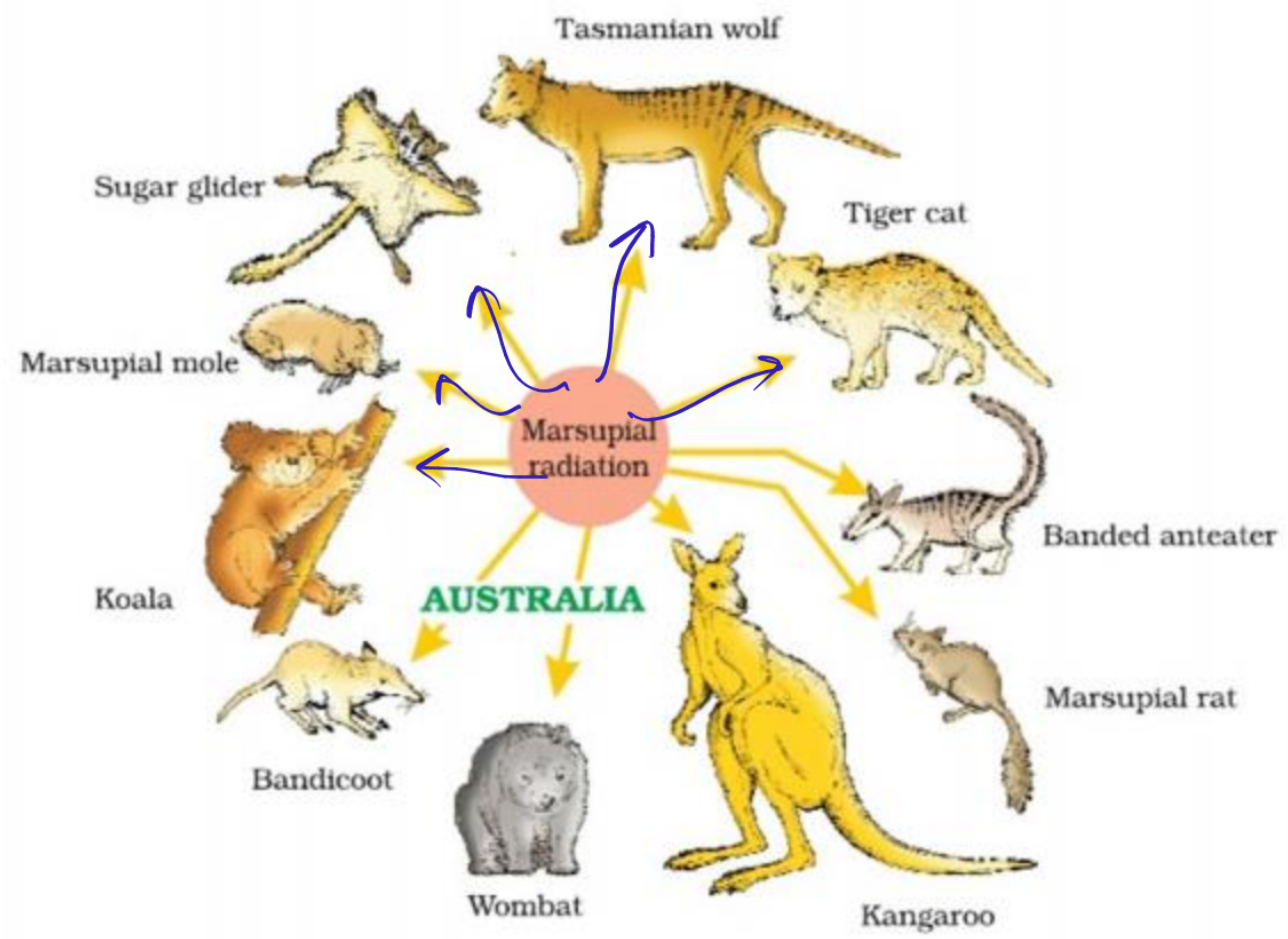


Figure 7.6 Adaptive radiation of marsupials of Australia

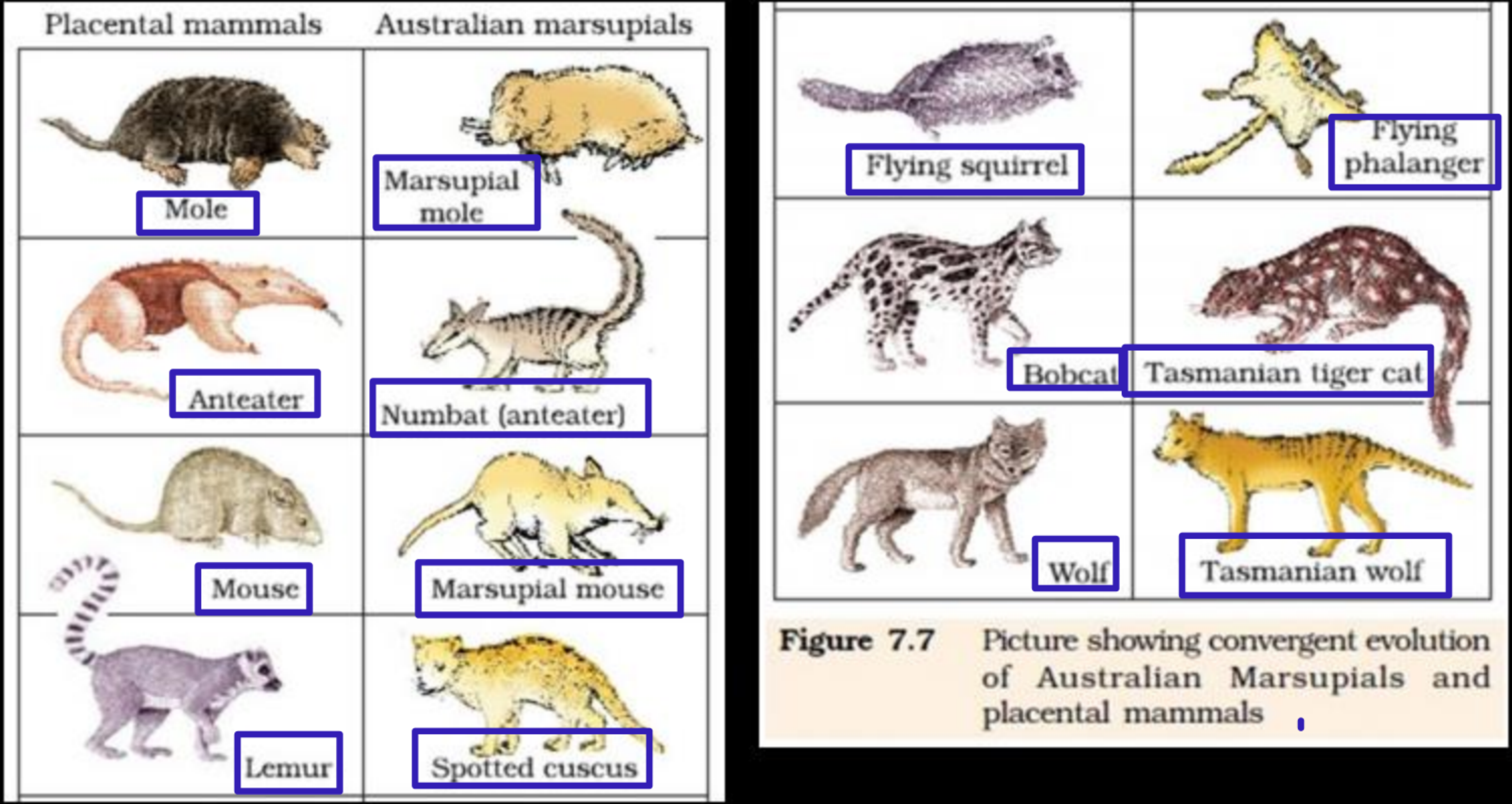
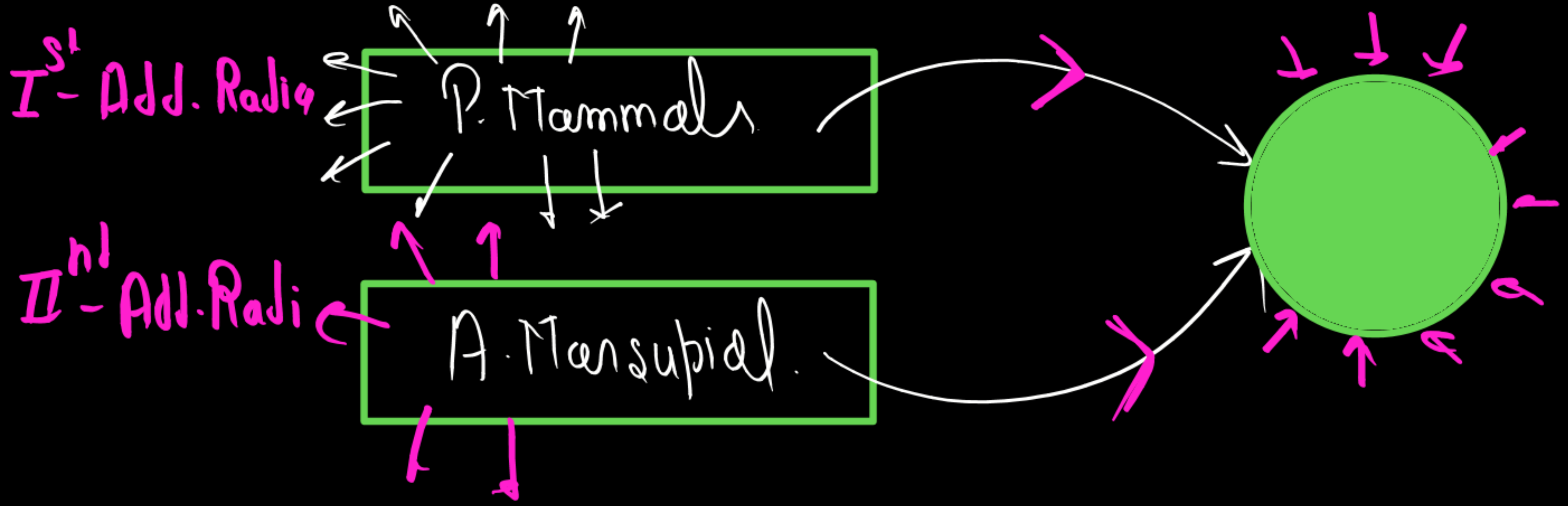


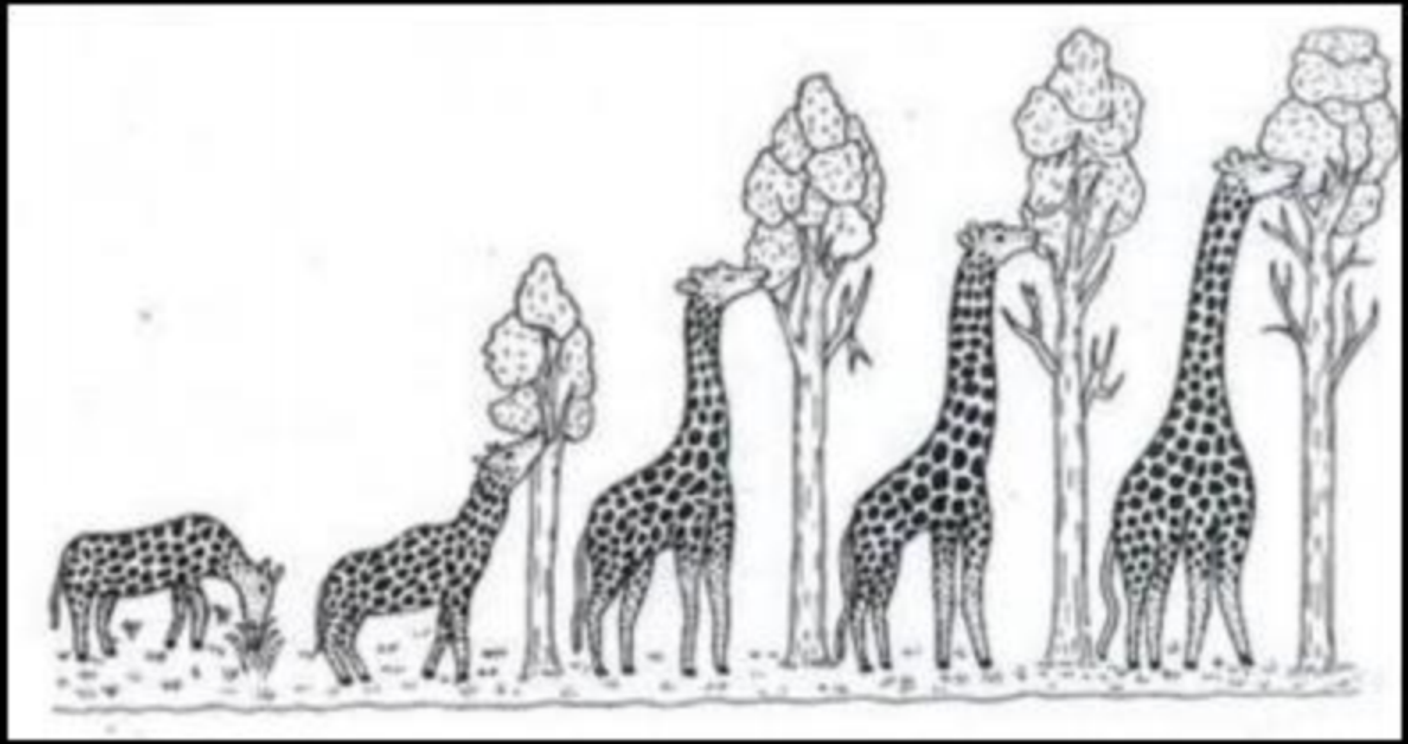
Figure 7.7 Picture showing convergent evolution of Australian Marsupials and placental mammals

- When more than one adaptive radiation appeared to have occurred in an isolated geographical area (representing different habitats), one can call this convergent evolution.
- Placental mammals in Australia also exhibit adaptive radiation in evolving into varieties of such placental mammals each of which appears to be 'similar' to a corresponding marsupial (e.g., Placental wolf and Tasmanian wolf-marsupial).



Biological Evolution –

(1) Lamarck's Theory of Evolution -



THANK YOU !!

MANTHAN NEET

EVOLUTION

LECTURE - 3

ZOOLOGY



MD SIR

TODAY'S GOAL

- Biological evolution
- Darwinism
- Mutation Theory
- MODERN SYNTHETIC THEORY
- HARDY-WEINBERG PRINCIPLE

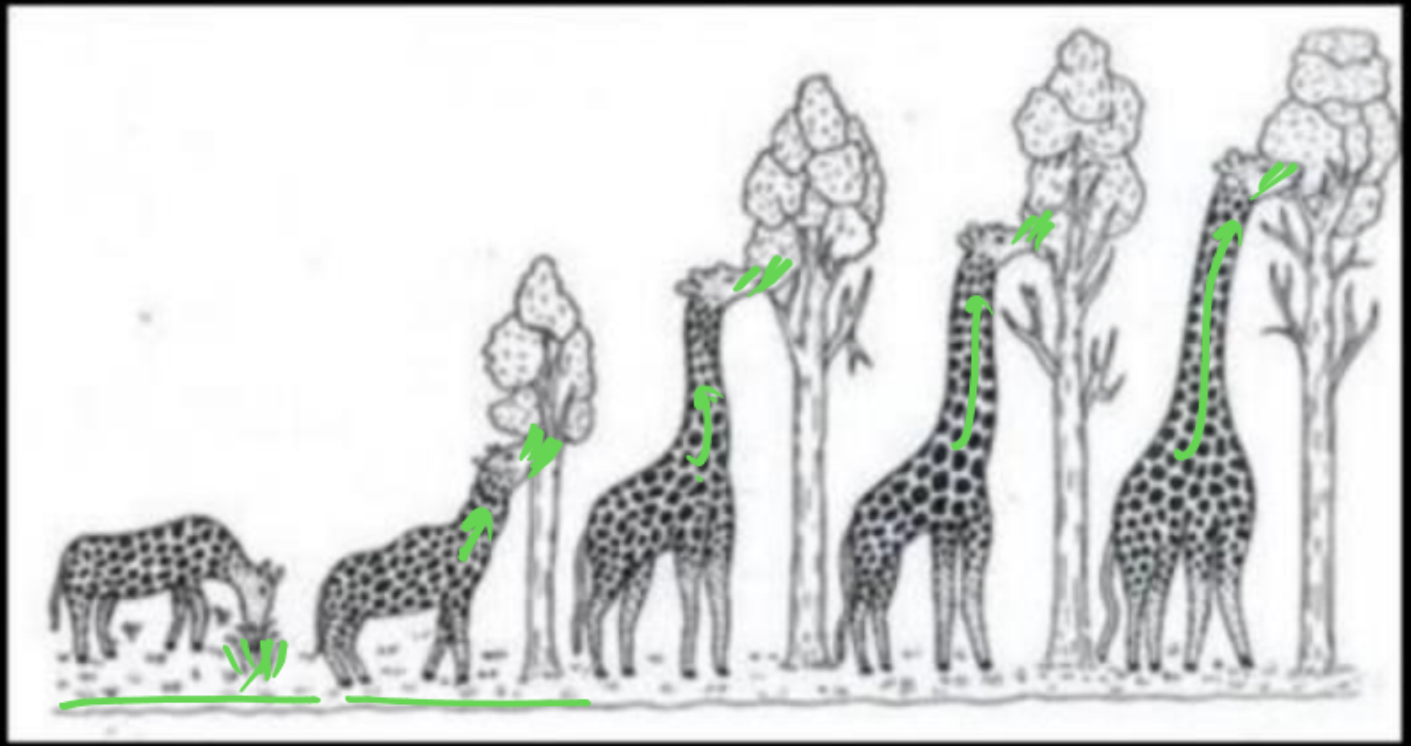
Biological Evolution –

(1) Lamarck's Theory of Evolution -

* Inheritance of acquired characters
or
use & disuse of organs.

Theory

Book = Philosophic Zoologique.



Discarded by - Weisman's Germplasm theory

Somatoplasm ✗

Germplasm → Inherit

(2) Darwinism -

- Theory of Natural Selection or Origin of Species } (1859)
- Darwin was influenced by ⇒
  An Essay on principle of Population = By = T.R. Malthus
- Alfred Wallace = Naturalist, = Malay Archipelago
  [Similar Conclusion around same times]

Main points of Theory of Natural Selection

1) - High rate of Reproduction

2) - Total number almost Constant

3) - Struggle for existence [Competition]

- [Intra specific] (b/w member of Same Species)
- [Interspecific] [b/w Member of different Species]

4) - Variation & Heridity → ⓐ [Continuous Variation]

- [Adaptive] (useful)
- [Nonadaptive] (Harmful)

5) - Natural Selection → Individual with max^m useful Variation Selected by = Nature

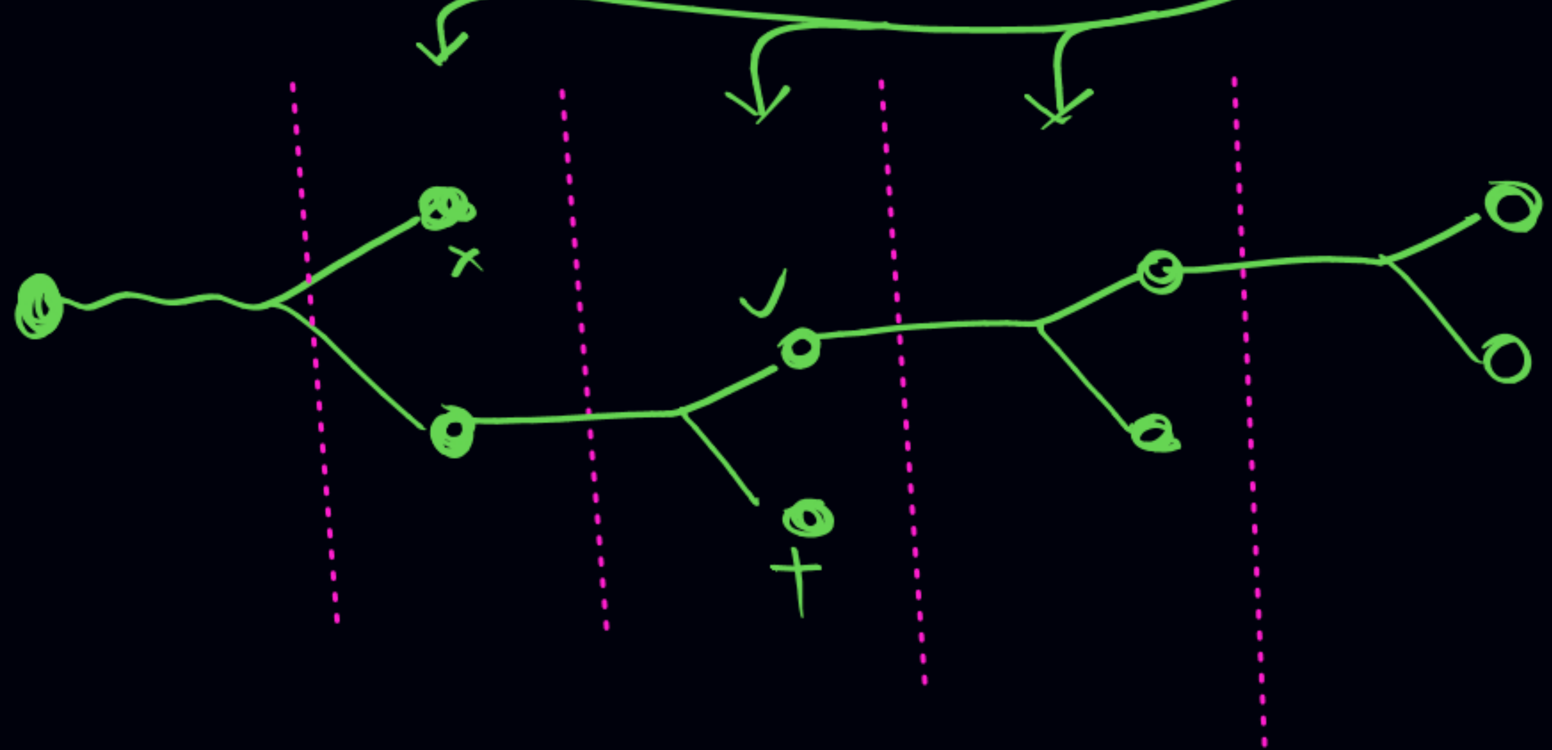
6) - Survival of fittest → Fitness is **end result** of the ability to adapt & get Selected by Nature.

* Two Key Concepts of Darwin theory

vvvImp

[Branching Descent]
[Direction of Evolution]

[Natural Selection]
[Mechanism of Evolution]



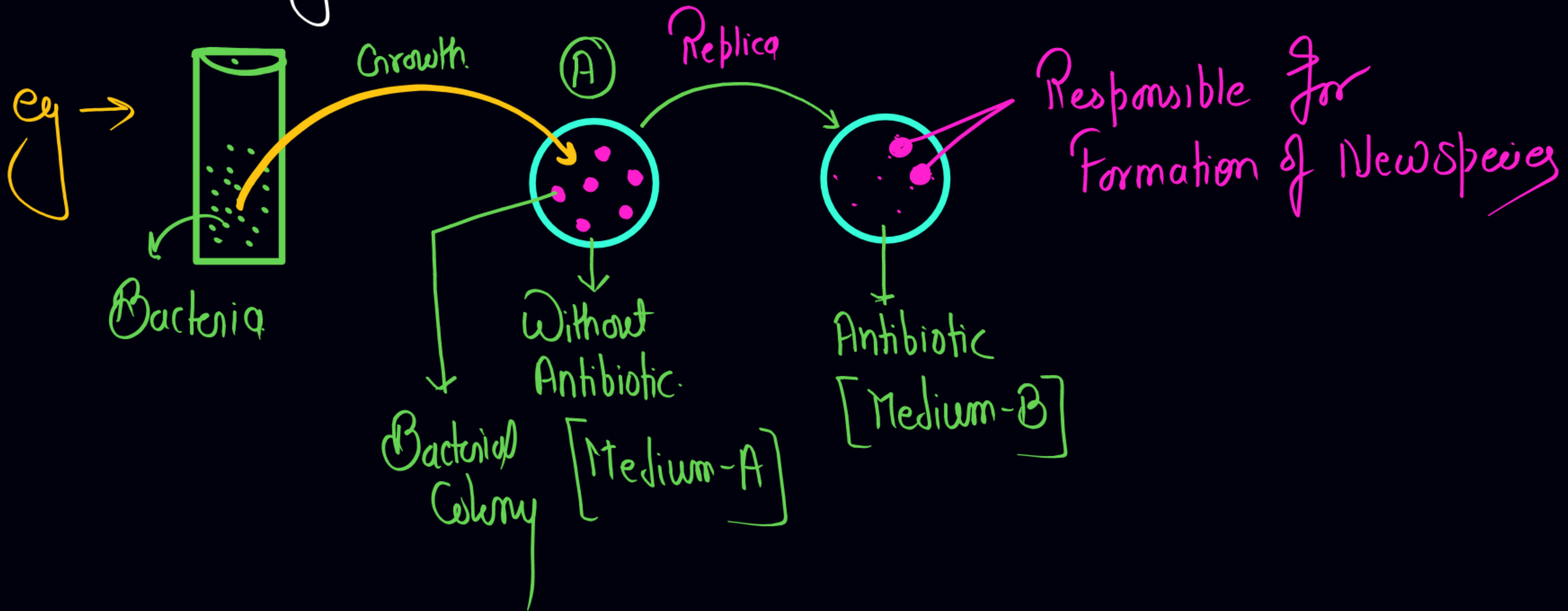
7.5 Biological Evolution

Evolution by natural selection, in a true sense would have started when cellular forms of life with differences in metabolic capability originated on earth.

The essence of Darwinian theory about evolution is natural selection. The rate of appearance of new forms is linked to the life cycle or the life span. Microbes that divide fast have the ability to multiply and become millions of individuals within hours. A colony of bacteria (say A) growing on a given medium has built-in variation in terms of ability to utilise a feed component. A change in the medium composition would bring out only that part of the population (say B) that can survive under

the new conditions. In due course of time this variant population outgrows the others and appears as new species. This would happen within days. For the same thing to happen in a fish or fowl would take million of years as life spans of these animals are in years. Here we say that fitness of B is better than that of A under the new conditions. Nature selects for fitness.

* Darwin Said that the appearance of New life forms due to ⇒ Accumulation of Variations from one generation to another.



mammals

One must remember that the so-called fitness is based on characteristics which are inherited. Hence, there must be a genetic basis for getting selected and to evolve. Another way of saying the same thing is that some organisms are better adapted to survive in an otherwise hostile environment. Adaptive ability is inherited. It has a genetic basis. Fitness is the end result of the ability to adapt and get selected by nature.

Branching descent and **natural selection** are the two key concepts of Darwinian Theory of Evolution (Figures 7.7 and 7.8).

Industrial Melanism

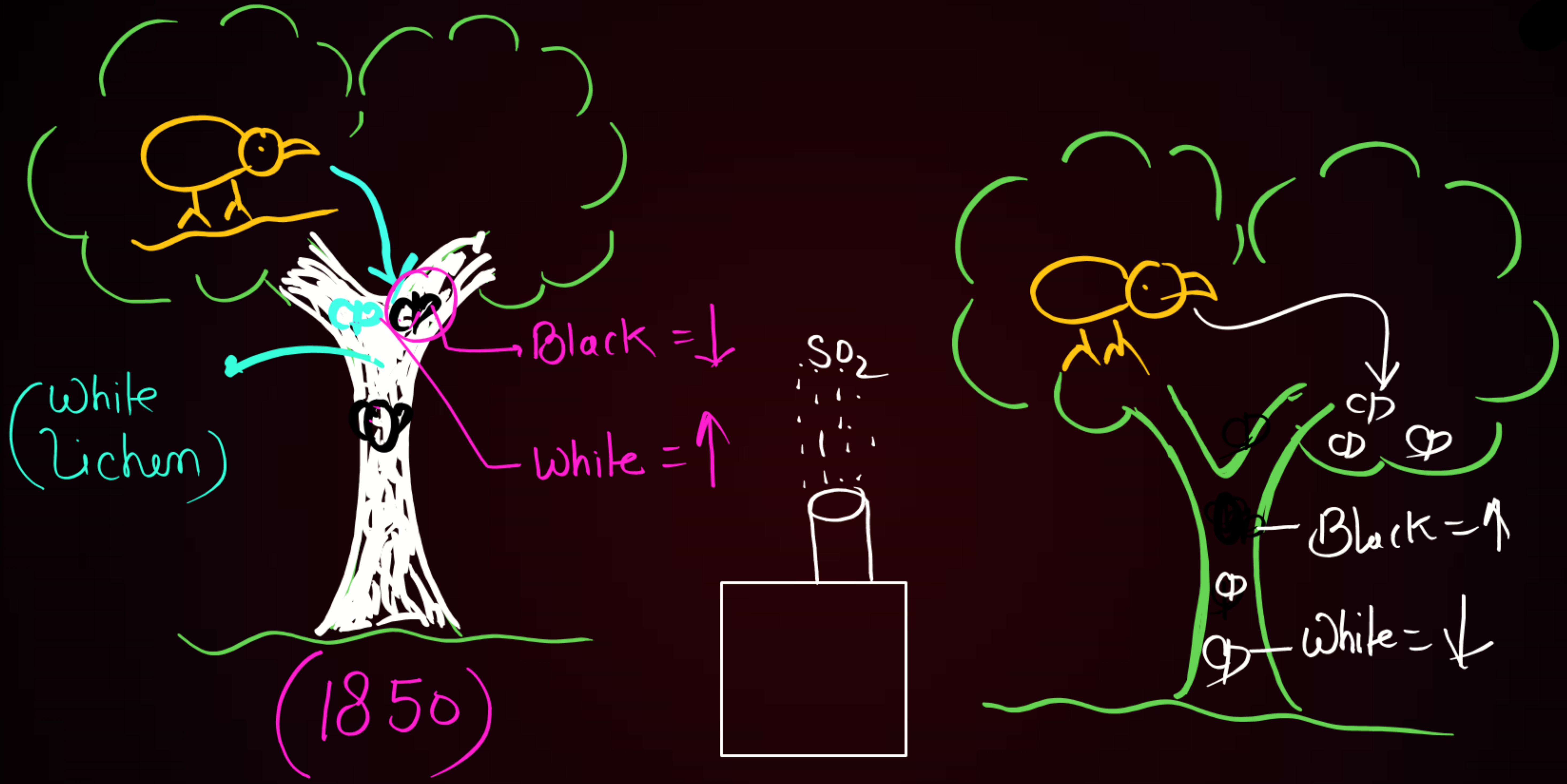


Peppered Moth
or
Biston butularia

@ [England]

[Before Industrilisation]
[1850]
- Black Moth = ↓
- White Moth = ↑

[After Industrilization]
[1920]
- Black = ↑
- White = ↓


(White Lichen)
Black = ↓
White = ↑
(1850)
SO_2
Black = ↑
White = ↓



Artificial Selection (Darwin)

Man has bred selected plants and animals for agriculture, horticulture, sport or security. Man has domesticated many wild animals and crops. This intensive breeding programme has created breeds that differ from other breeds (e.g., dogs) but still are of the same group. It is argued that if within hundreds of years, man could create new breeds, could not nature have done the same over millions of years?

(3) Mutation Theory → Hugo de Vries

↳ work on - Evening primrose or (Oenothera lamarckiana)

According to this theory →

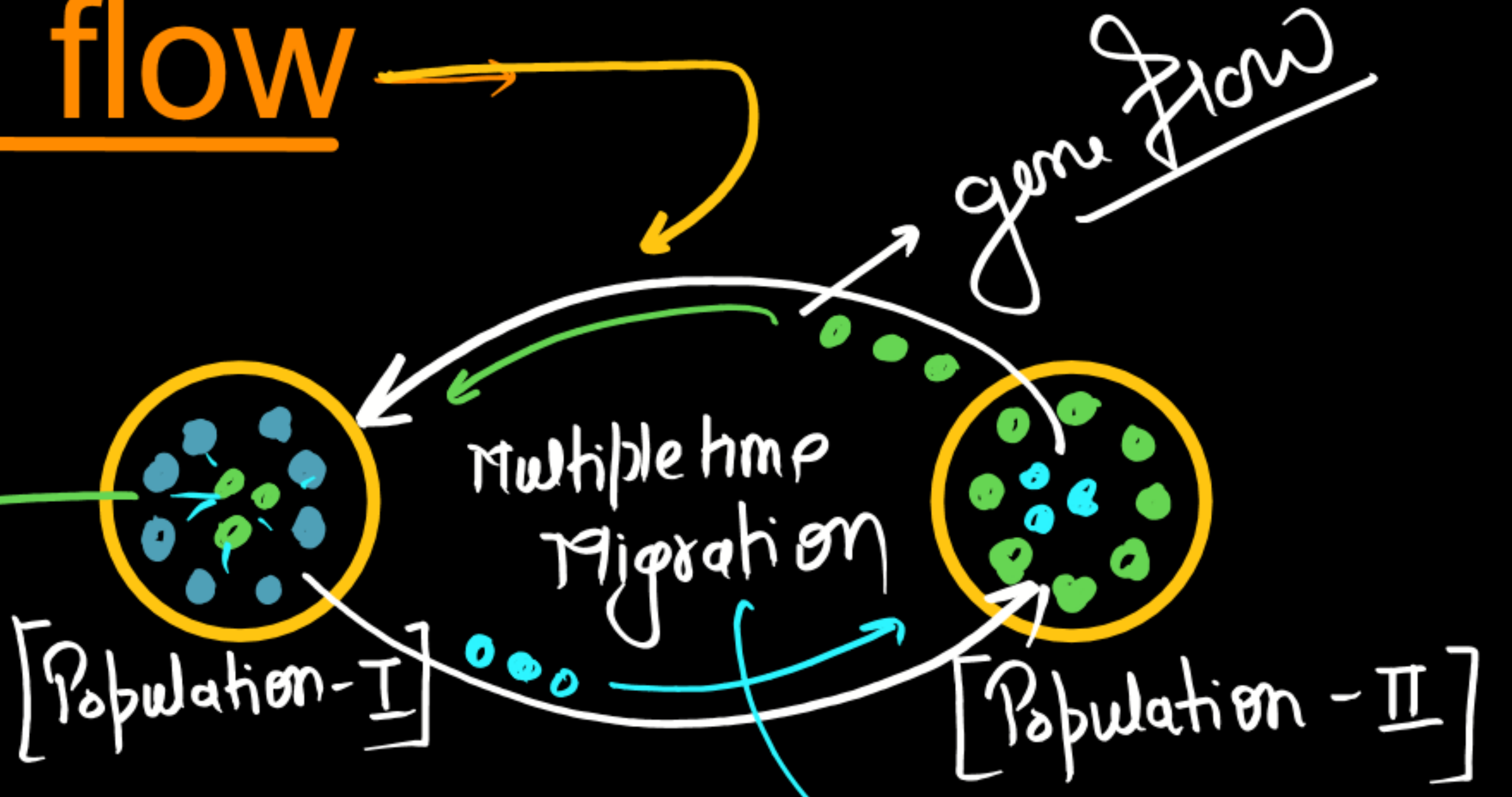
* Mutation are responsible for Evolution
* Mutation provide raw material for evolution
* Variation are large, Discontinuous & Nondirectional, Random
* Evolution is Sudden & jerky Process. → Called - Saltation (Single Step Large Mutation)

MODERN/SYNTHETIC THEORY

- Many factors are collectively responsible for formation of new species :⟶

1) - Gene migration/gene flow
2) - Genetic Drift } imp
3) - Mutation
4) - Genetic Recombination
5) - Natural Selection

(1) Gene flow

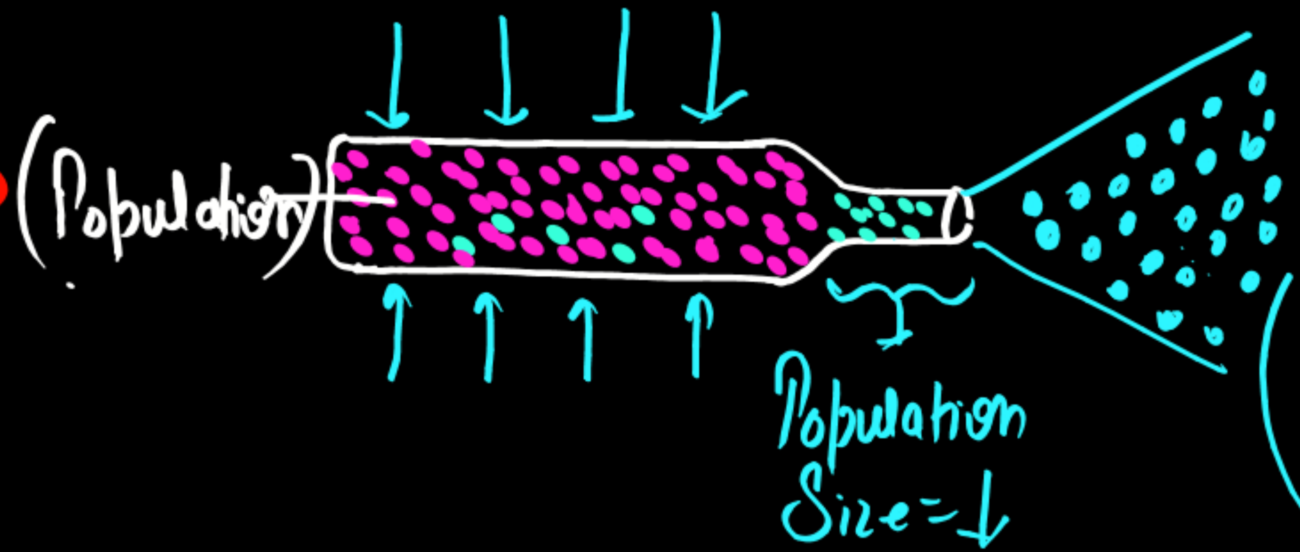


Gene pool → [Collection of all gene and its alleles in a population]

Change in gene pool → Responsible for formation of New Species.

(2) Genetic Drift → Bottle Neck Effect

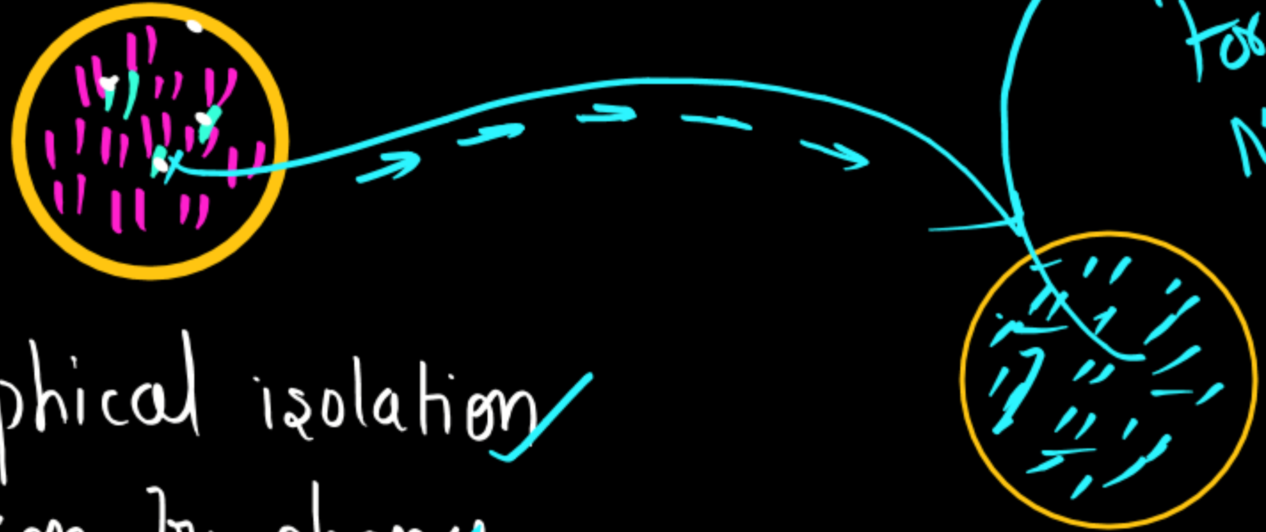
Small Population



Responsible for Formation of New Species.

- Randum / Nondirectional changes of gene frequencies in small Population by Chance.

Founder effect

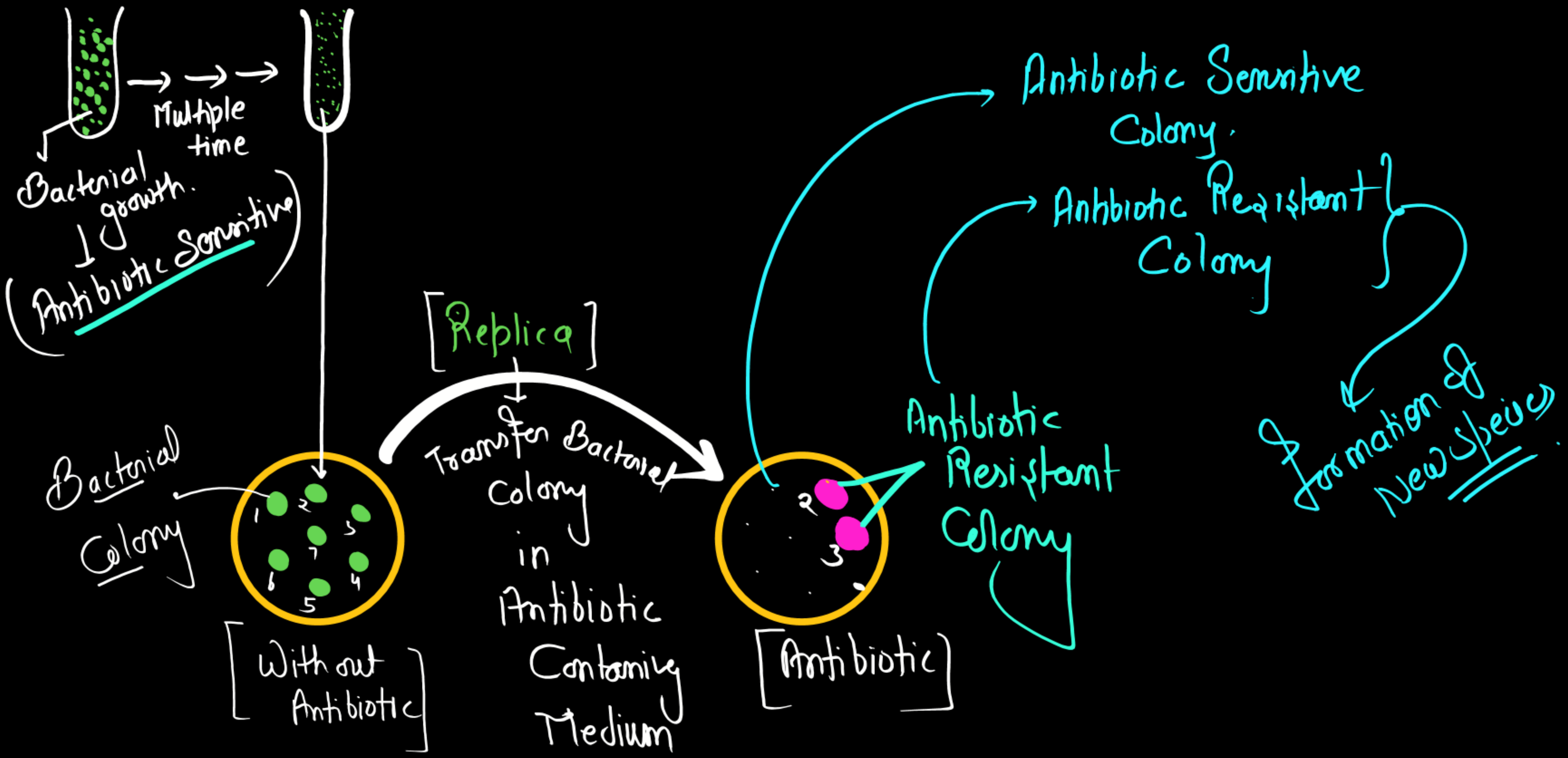


- May - ↑ or ↓ (Size of Population) Due to
  - Geographical isolation ✓
  - Migration by chance ✓
  - Natural Calamity. ✓

(3) Mutation/Genetic Basis of Adaptation

Lederberg's experiments →

- Microbial experiments show that –
  Pre-existing advantageous mutation, when selected will result in observation of new phenotypes
- Over few generation, this would result in Speciation



Multiple time
Bacterial growth
(Antibiotic Sensitive)
[Replica]
Transfer Bacterial Colony in Antibiotic Containing Medium
Bacterial Colony
1
2
3
4
5
6
7
[Without Antibiotic]
[Antibiotic]
2
3
Antibiotic Resistant Colony
Antibiotic Sensitive Colony.
Antibiotic Resistant Colony
Formation of New species

Note

The new environment does not induce the mutation it only Selects the preadaptive mutation that occurred earlier

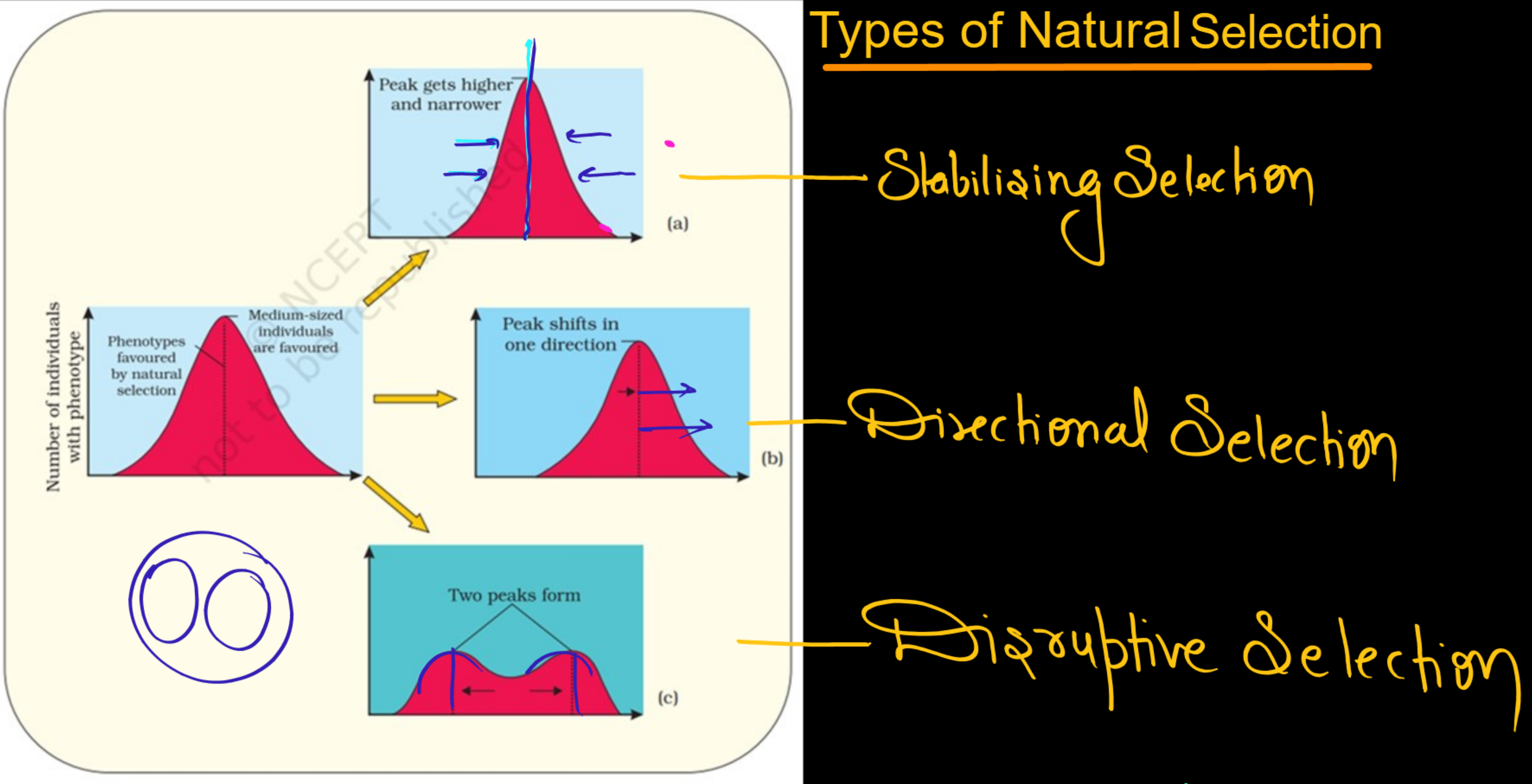
(4) Natural Selection →

eg- Industrial Melanism ✓
- Evolution of Pesticide Resistant mosquito
- Antibiotic Resistant microbes

} Directional Selection.

- Sickle Cell Anaemia → Stabilising.
- Darwin finches etc.

Types of Natural Selection



7.8 Diagrammatic representation of the operation of natural selection on different traits : (a) Stabilising (b) Directional and (c) Disruptive

THANK YOU !!

MANTHAN NEET

EVOLUTION

LECTURE - 4

ZOOLOGY



MD SIR

TODAY'S GOAL

- HARDY-WEINBERG PRINCIPLE
- A Brief account of evolution
- Human evolution

HARDY-WEINBERG PRINCIPLE -

Population (Large) — Frequency of occurrence of alleles of gene or locus or Individual

Imp

♂ → 23
♀ → 23
} 46



AA
aa
Aa

A = p
a = q

$$p^2 + q^2 + 2pq = 1$$

AA aa Aq

$$(p+q)^2 = 1$$

$$p+q = 1$$

* Gene or allelic frequency in a large population remains constant over generations

if →
- Mating occur at random
- absence of above 5 factors →

1) - Mutation
2) - Genetic drift
3) - Recombination
4) - Gene migration
5) - Natural Selection

Q = Presence of recessive trait is 16%, The frequency of dominant allele in a population is - ?

q^2 (above "recessive trait"); $P = ?$ (below "allele")

$q^2 = 16\% = 0.16$

$q = \sqrt{0.16} = 0.4$

$P = ?$

$P + q = 1$

$P = 1 - q$

$= 1 - 0.4 = 0.6$

A Brief account of Evolution →

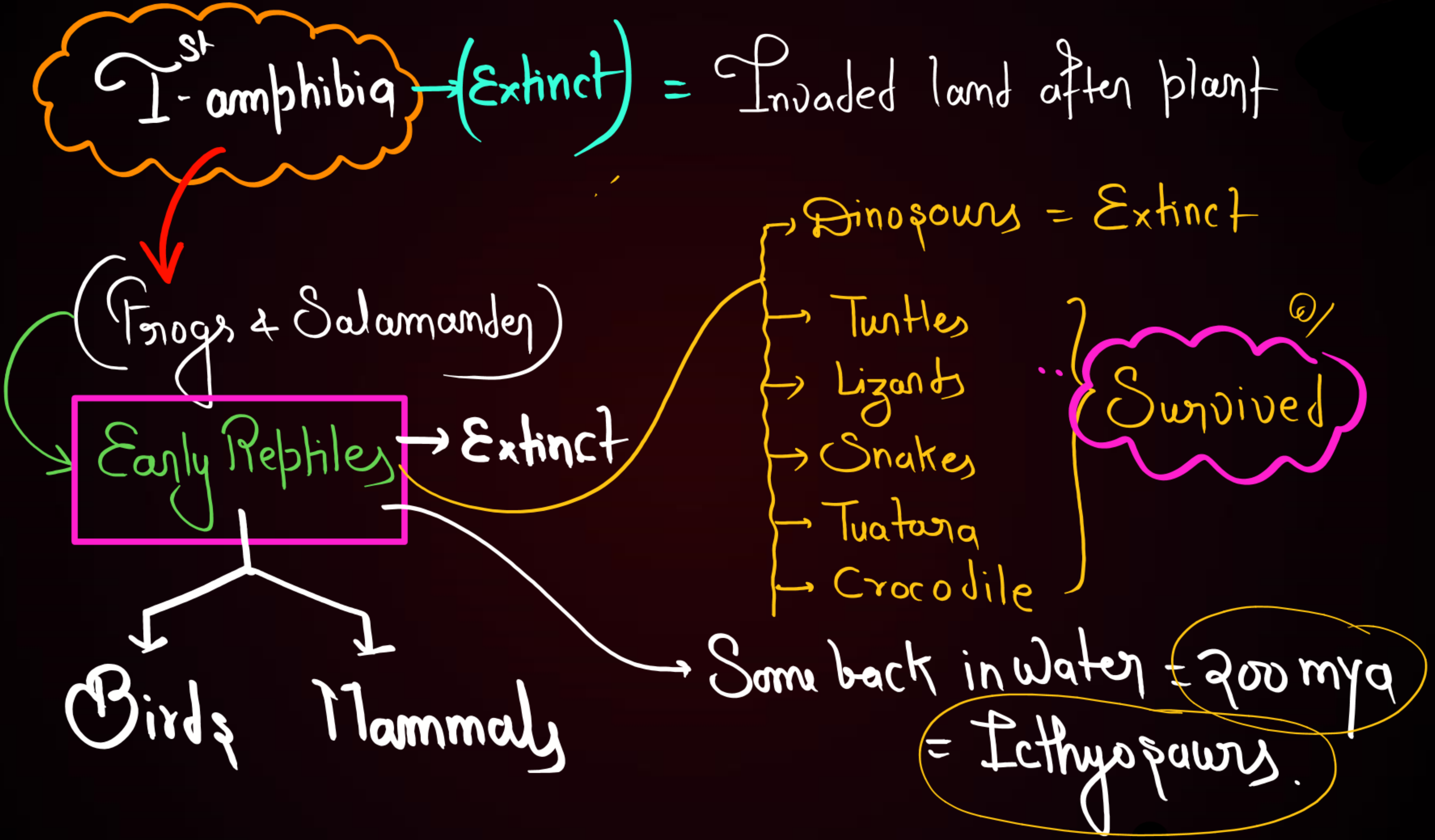
- Ist acellular life = 3 BYA
- Ist Cellular life = 2 BYA
- Invertebrate become active = 500 MYA
- Ist Vertebrate (jaw less fish) = 350 M.Y.A
- Ist jawed Vertebrate = 350 M.Y.A.

eg = Latemaria / Coelacanth / Lobe fin fish → Living fossil

→ Caugh in South africa (1938)

→ Though to be extinct

→ Ist amphibia


1st amphibia → (Extinct) = Invaded land after plant
(Frogs & Salamander)
Early Reptiles → Extinct
Dinosaurs = Extinct
Turtles
Lizards
Snakes
Tuatara
Crocodile
Survived
Birds
Mammals
Some back in water = 200 mya
= Icthyosaurs.

* Dominating land reptile in jurassic period = 150 mya
* Biggest Dinosaur → Tyrannosaurus rex (Hight = 20 feet
* About = 65 mya → Dinosaurs suddenly Disappeared from Earth [In Cretaceous period]

→ Modern Birds
→ Mammals
→ Flowering Plants [Angiosperms]

Sauropsids

Synapsids

Era →

Quaternary

↑

Tertiary

↑

Cretaceous (100 MYA)

↑

Jurassic (150 MYA)

↑

Triassic (200)

↑

Permean

↑

Carboniferous

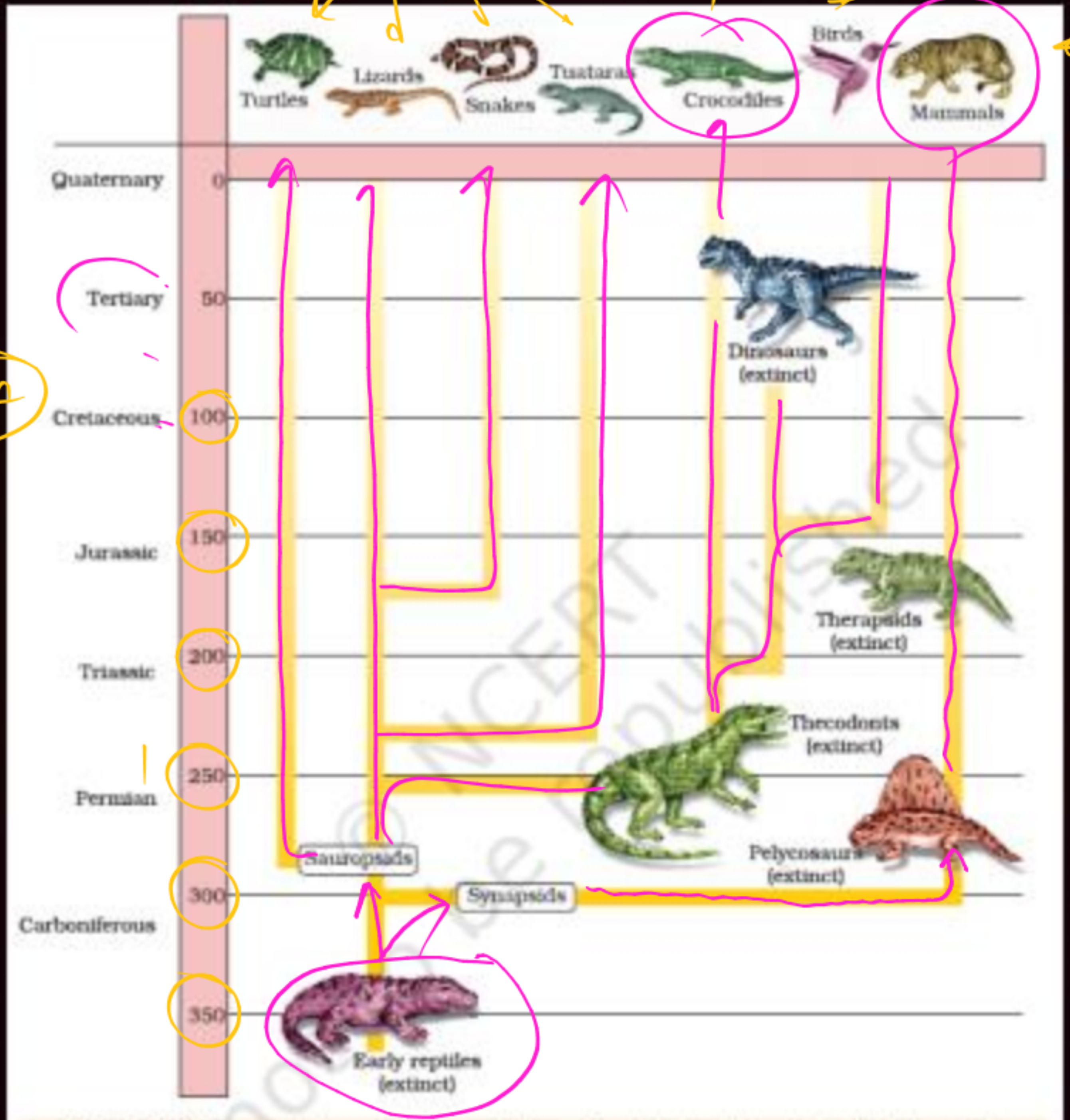


Figure 6.10 Representative evolutionary history of vertebrates through geological periods

Human Evolution

Primats

- Pro simians → Lemur, Loris etc
- Anthropoids (Simians)
  - Monkeys
    - New World Monkey
      - eg - Spider monkey
    - Old World Monkey
      - eg - Rhesus monkey
      - Q// [Closed to Human]
  - Apes
    - Gibbon (100 cc)
    - Orangutan (400 cc)
    - Gorilla (550 cc)
    - Chimpanzee (400 cc)
    - Q// [Closed to Human]

Human

1. Rama - Shiva pithacus
   ↓
2. Australopithecus (Ape - Man) (500 - 700 cc)
   ↓
3. Pre historic Man
   - Homo habilis (650 - 800)
   - Homo erectus (900 cc)
   ↓
4. Modern Man
   - → Neanderthal (1400 cc)
   - → Cromagnon (1650 cc)
   - → Homo Sapiens - sapiens (1400 cc)

Origin of man →

15 M.Y.A

- Dryopithecus [Africa & Europe]
  - Ape like
  - Eat Fruits
- Rama pithecus [India]
  - Man like
  - Eat Hard nut & Seed

Walk like gorilla & chimpa.

3-4 M.Y.A → Man like Primates

- With Hominid feature
- Discovered in Ethiopia & Tanzania
- Hight = 4 feet

Australopithecus
[500- 700 cc]
(2-5 MYA)

- 1st Ape-man
- 1st Hominid → Bipidal locomotion
- 1st Erect Man
- Lived in = East Africa

- Aus. africanus — African ape man; Tuang baby
- Aus. afarensis — Lucy

- Hunted with Stone weapons → Protection
- Eat = Fruits.



Australopithecus Afarensis



Homo Habilis

Pre-Historic man →

1) → Homohabilis (2 M.Y.A.) (East Africa)
- → Skill full man / Tool maker / Handy Man
- → 650 - 800 c.c.
- → I[st] Human being like
- → Probably not eat meat

↓

2) → Homo erectus (1.5 M.Y.A)
- → 900 c.c.
- Carnivorous
- I[st] Man used fire for Hunting, Protection & Cooking
- Complete erect

↓

- Java-man (Indonasia)
- Peking-man (Bejing)
- Heidelberg (Germany)

Modern man →

1) - Neanderthal
(10,0000 - 40,000 Y.B.)

- → 1400 C.C. (like Homo sapiens) @
- → Near east Central Asia ✓
- → Speech Centre developed ✓
- → Civilisation Start @// @//
  - → made huts ✓
  - → used Hides for Protect their body ✓ @
  - → Started buried their dead → Immortality of Soul @

↓

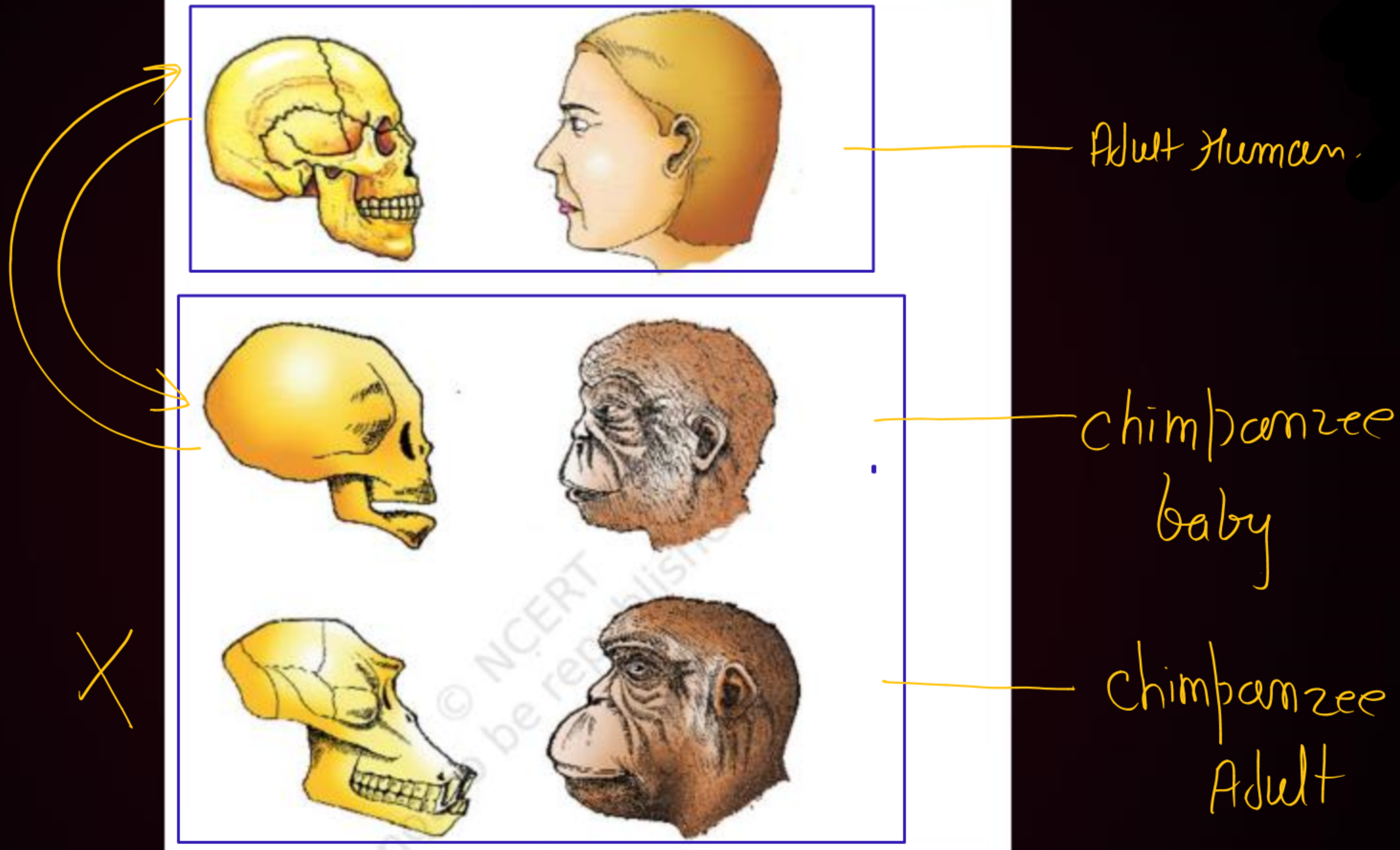
2) - Cromagnon
[50,000 - 10,000 Y.B]

- → 1650 - C.C
- → Panted Panting on Cave wall @ (18,000 Y.B.)

↓

3) - Homo - Sapiens - sapiens
[10,000 Y.B.]

- 1400 - C.C
- Agriculture Started.



A comparison of the skulls of adult modern human being, baby chimpanzee and adult chimpanzee. The skull of baby chimpanzee is more like adult human skull than adult chimpanzee skull

15- M.Y.A → Dryopithecus = Ape like

3.4- M.Y.A → Ramapithecus = Man like → Ethopia & Tanzania → 4 feet

2-5- M.Y.A → Australopithecus = Ape-Man

2- M.Y.A → Homo habilis = Skillfull Man - Not eat Meat

1.5 - M.Y.A → Homo erectus = Fire, eat Meat

10,000-40000 Y.B → Neanderthal = Speech, Civilisation

50,000 - 10,000 Y.B → Cromagnon = Cave Painting

10,000 Y.B. → Homo-Sapiens-Sapi. = Agriculture

THANK YOU !!